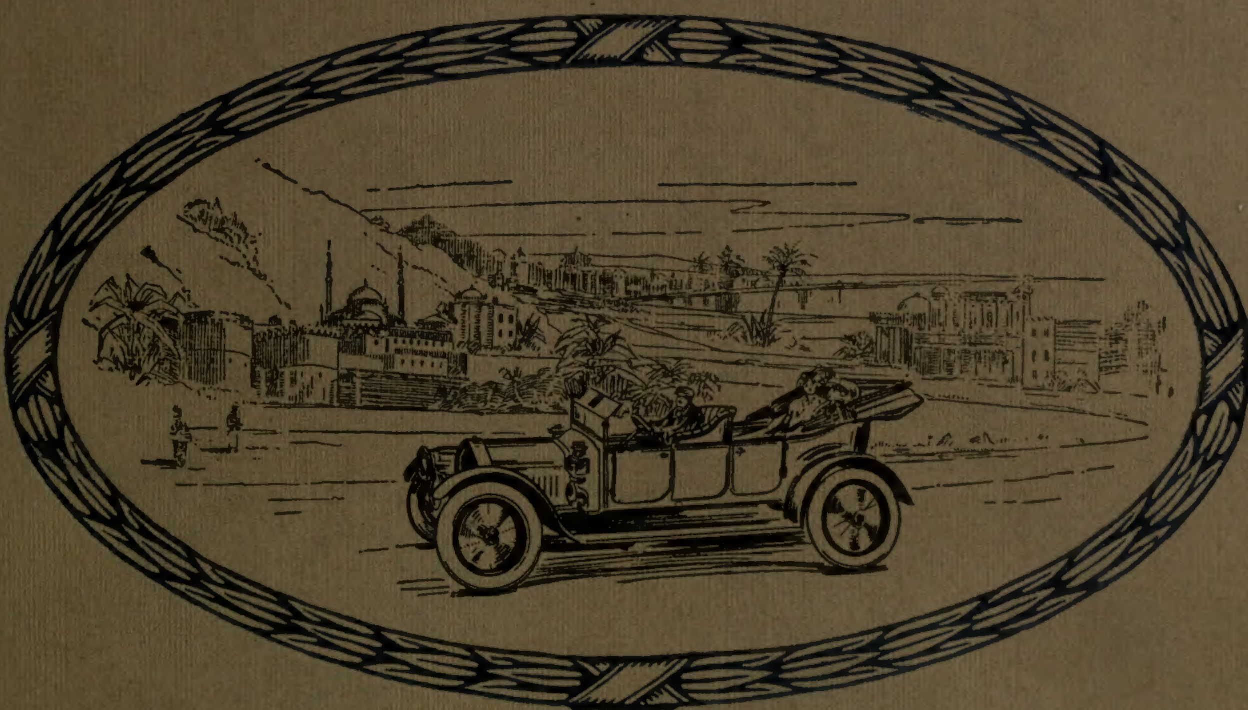
The Autocar

IMPERIAL YEAR BOOK 1913

FOR CIRCULATION IN THE COLONIES OVERSEAS DOMINIONS AND ABROAD



2/6 NET

PUBLISHED ANNUALLY BY ILIFFE & SONS LTD

20 TUDOR ST LONDON E C ENGLAND

Daimler

Since the introduction of the New Daimler Engine the Company have been honoured with orders for more than 7,500 Cars, among the Purchasers being:

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Mons. Edmond Rostand.
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Mons. Jellineck-Mercedes.
Madame Sarah Bernhardt.
Madame Melba.
The Japanese Household.
The Siamese Legation.
The War Office.
The India Office.
The Royal Automobile Club.

The Daimler Company, Limited,
Coventry.

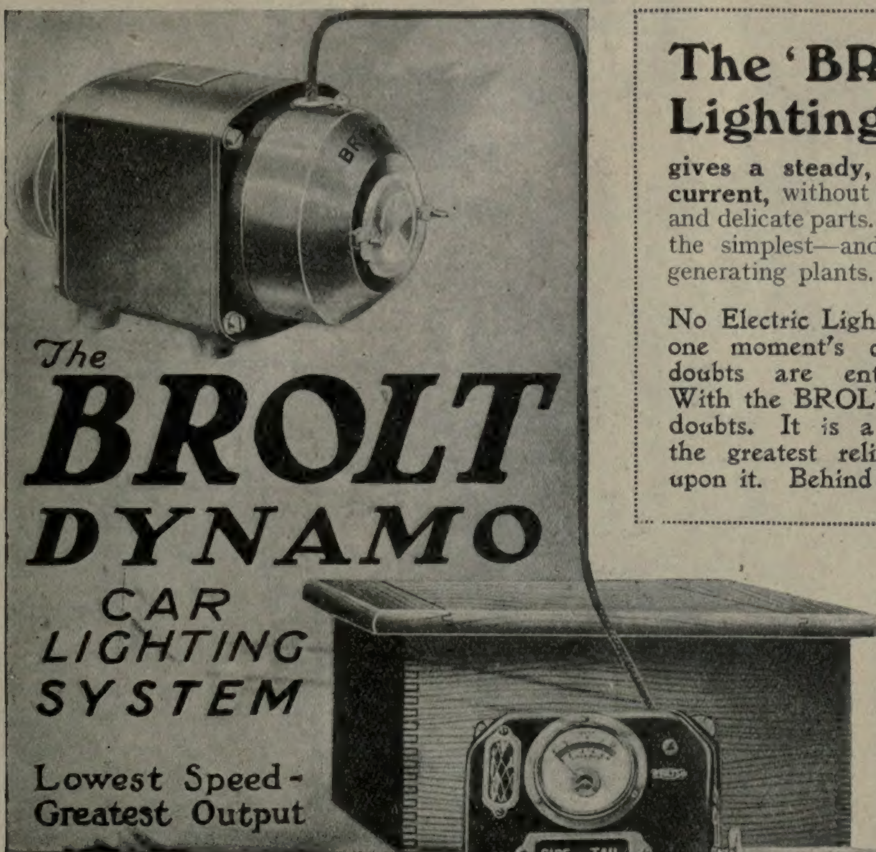
BROWN BROTHERS, Ltd.,

Codes—ABC, Lieber's, Premier & Western Union.

Great Eastern St. LONDON. E.C.

Cables:— "Imbrowned, London."

Australian Representatives: R. Miles & Co., Ltd., Equitable Buildings, Melbourne. South African Representative: E. G. Higginson, P.O. Box 1269 Johannesburg.



The 'BROLT' Car Lighting Dynamo

gives a steady, constant supply of current, without the aid of complicated and delicate parts. The "Brolt" is easily the simplest—and the best—of all car generating plants.

No Electric Lighting System is worth one moment's consideration if any doubts are entertained of failure. With the BROLT you can dismiss all doubts. It is a proved success, and the greatest reliance can be placed upon it. Behind the BROLT are years of experience, and for simplicity, brilliancy, and reliability, it easily stands first. Cheap to fit, it can be easily adapted to ANY CAR.

The "BROLT" Dynamo is absolutely simple, without governors, clutches, switches, etc. Full output given at lowest speed of any on the market, and is perfectly constant. Cool and sparkless running.

Batteries of lower voltage can be charged if desired, as the dynamo output cannot possibly exceed its rated amount.

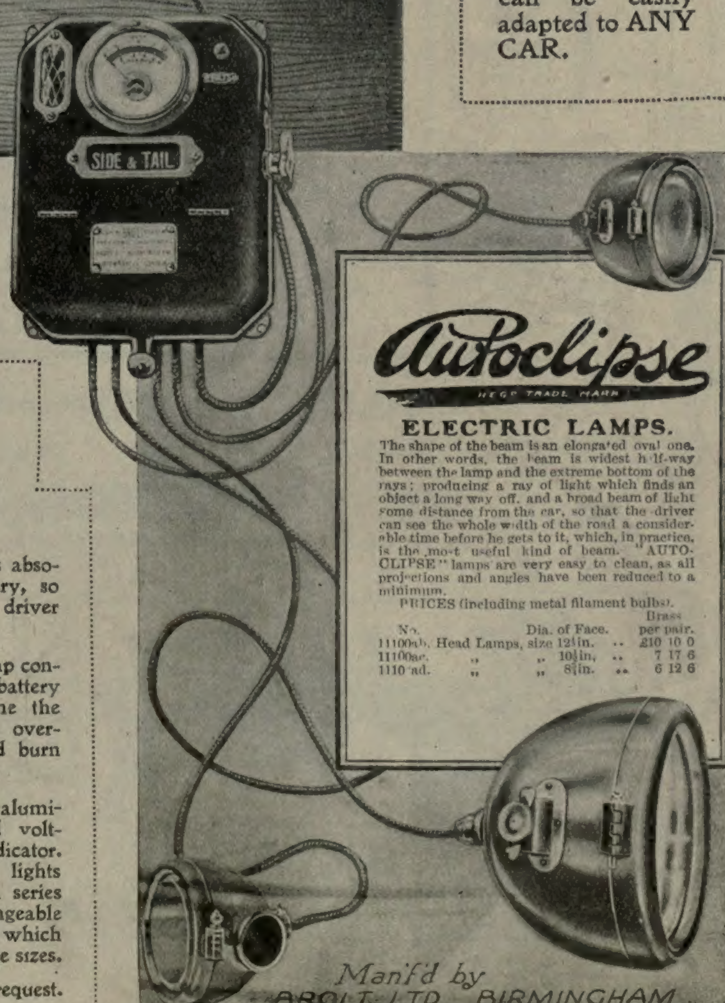
The dynamo cannot be burned out by a short circuit, as it wou'd merely fail to excite. Dynamo is totally enclosed, and weatherproof.

When the dynamo is not running there is absolutely no current drawn from the battery, so the battery is not discharged should the driver omit to switch off.

The output of the dynamo is equal to lamp consumption, so that nothing is drawn from battery while running, while at the same time the battery voltage is not increased, due to overcharging, in which case the lamps would burn out quickly.

The "BROLT" SWITCHBOARD has aluminium cover. Combined ammeter and voltmeter. Patent switch with visible indicator. Tell-tell indicator with red lamp, which lights up if tail lamp goes out. This is not in series with tail lamp, which can be interchangeable with side lamps. Contains auto cut-out which is quite positive. Dynamo is made in three sizes.

Catalogue giving full particulars post free on request.



BROWN BROTHERS, Ltd.,

Codes—ABC, Lieber's, Premier & Western Union.

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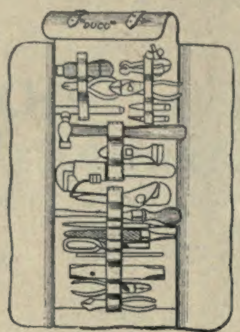
Cables:— "Imbrowned, London."

Australian Representatives: R. Miles & Co., Ltd., Equitable Buildings, Melbourne. South African Representative: E. G. Higginson, P.O. Box 1259 Johannesburg.

No. 7222. **Pillar Drilling Machine.**
No. 7222a. To drill 13/16in. for hand, each £11.
No. 7222b. Ditto, hand and steam each £11 10 0.

No. 7223. **Pillar Drilling Machine**
To drill to 1 9/16in. weight 6¼ cwt.
No. 7223a. For hand each **£14 10 0**
No. 7223b. For hand and steam, each **£15 10 0.**



No. 8551a.
THE "DUCO" MOTOR TOOL KIT.
Complete with 19 tools and case, each £2 16 3.
No. 8551f.
Cases only (minus tools) each 15/.

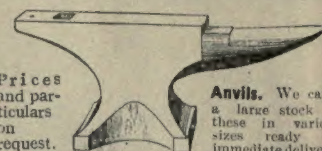
Not a Toy by any means, but a practical article, small in size, and quite as efficient as a large blow lamp.

The "IMP" Petrol Blow :: Torch ::

Heats or solders anything, and is indispensable where quick, clean, cheap, and intense heat is desired. Produces a perfect Bunsen flame of over 2,000 degrees Fahrenheit, while the corrugated neck largely increases the heating surface and creates a greater pressure than could otherwise be obtained. Perfectly safe, and will not get out of order.

Simple, efficient, and powerful. No household can afford to be without one. Can be used for hand or bench work.

Price, **5/-** each.



Prices and particulars on request.

Anvils. We carry a large stock of these in various sizes ready for immediate delivery.

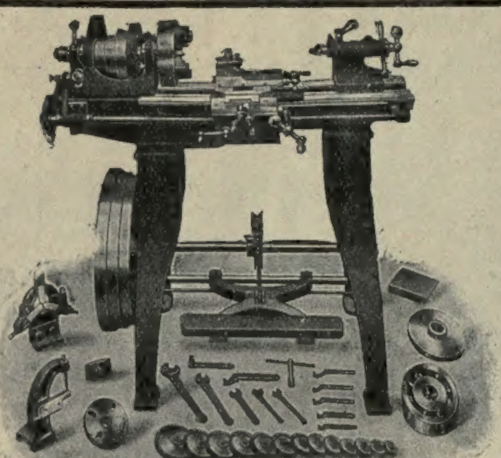
COMBINED FORGE, with BRAZING HEARTH

No. 7472a.	With 18in. bellows	each	£3 2 6
No. 7472b.	,, 20in. ,,	,,	£3 8 0
No. 7472c.	,, 22in. ,,	,,	£3 17 9

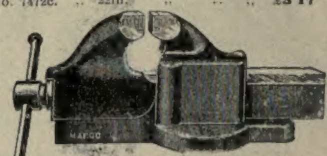
No. 7311a. **Tool Grinder,** with one wheel, each **£1 1 0**

English Combination Pliers.
Round or flat nose.

		each.
No 7999aa	6in	1/8
,, 7999a	6½in	1/10
,, 7999b	7in	2/-
,, 7999c	8in	2/4



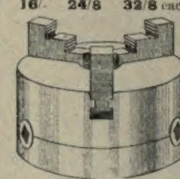
No. 7729d. **High-class Precision Self-acting, Sliding, Surfacing, and Screw-cutting Gap Bed Lathe. For power or treadle motion, same price.**
6in. centre, 5ft. 6in. bed, **£40.**



No. 8718. **The "MARCO" Vice. Cheap, Powerful, and Durable.**

	A	B	C	D	E	F	
Size	2½in.	3in.	3½in.	4in.	4½in.	5in.	
Price	7/-.	8/4	12/4	16/-	24/8	32/8	each

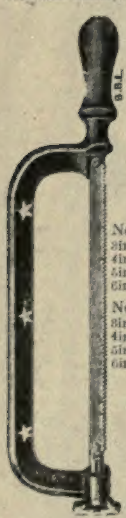
Engineers' Hammer Heads. Best quality.
No. 7601 Straight pane
,, 7602 Cross pane
,, 7603a Ball pane
Without shaft
1 lb and under, ea. **-/11**
Do. with shaft fitted. **1/4**
Without shaft
Above 1 lb., per lb. **-/9**
With shaft fitted, each extra



No. 7170.
"Marco" Cushman Pattern Lathe Chucks.
With 2 sets jaws.

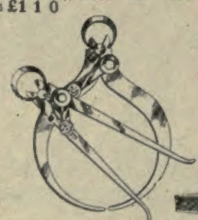
A	3in	each	£1 9 0
B	4in	,,	1 14 4
C	5in	,,	2 4 0
D	6in	,,	2 11 4
E	7½in	,,	2 18 8
F	9in	,,	3 8 8
G	10½in	,,	4 0 0
H	12in	,,	4 16 0

Each Chuck is guaranteed.



Hack Saw Frame.
With iron frame and wood handle to face in four different directions japanned

No.	For	each
7571a	8in blades	1/4
7571b	9in ,,	1/4
7521k	9in ,,	
Iron frame and handle		/9

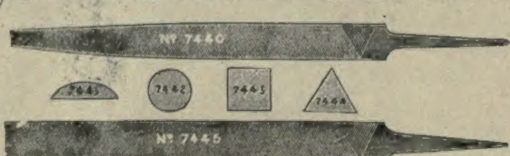


No. 7123 **Outside Callipers.**

3in Brown's	..	-/11 each
4in ,,	..	1/3 ,,
5in ,,	..	1/5 ,,
6in ,,	..	1/9 ,,

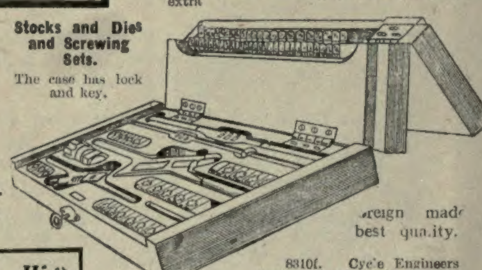
No. 7124 **Inside Callipers.**

3in Brown's	..	-/11 each.
4in ,,	..	1/3 ,,
5in ,,	..	1/5 ,,
6in ,,	..	1/9 ,,



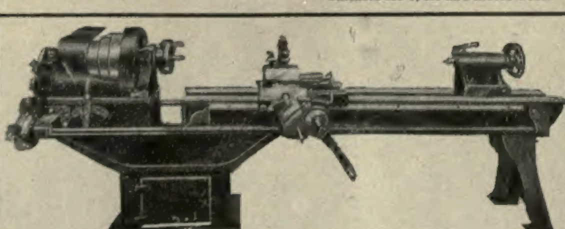
No. 7439. **FILES IN BOXES OF 1 DOZEN, ASSORTED, per box 8/6.**
These boxes contain a good assortment of sizes, shapes, and cuts most suitable for cycle and motor work.

Stocks and Dies and Screwing Sets.
The case has lock and key.



Foreign made best quality.

8810f. Cycle Engineers Stocks and Dies, each **£2-2-0.**
Second quality, each **£1-16-6.**

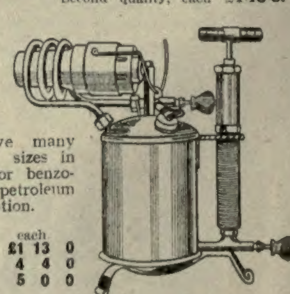


No. 7732d. **High Class English Back Geared Self-Acting, Surfacing and Screw-Cutting Lathe**
With two rates of back gearing.

Machine cut gears throughout, handle feed motion, spindles ground on dead centres, micrometer adjustment to surface screw, **loose head** to set over for taper turning, and **hollow spindle.** Positive feeds with steel clutches; interlocking device to prevent sliding and screw cutting motions being engaged at the same time. 8½ x 8ft., price £85.
Also made with 7½, 9½, 10½, and 12½in. centres.

Max Sievert Brazing Lamp.

We have many different sizes in stock, for benzoline or petroleum consumption.

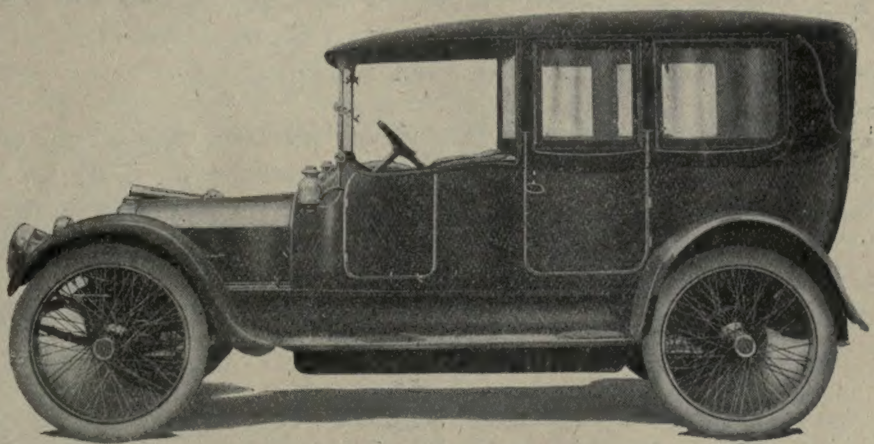


		each
2 pints	..	£1 13 0
4½ ,,	..	4 4 0
7 ,,	..	5 0 0

ARMSTRONG-WHITWORTH

Builders of Dreadnoughts.

THE success of the Armstrong-Whitworth Car at home and abroad is due not only to splendid workmanship, but also to the employment of the world famous material made and tested at the Armstrong-Whitworth Steel Works.



The 17-25 h.p. Armstrong-Whitworth Cabriolet.

Colonial Type. Price complete as shown, £856

General Chassis Specification of Colonial Models.

WHEEL BASE.—9ft. 8in. to 11ft. 9in.
WHEEL TRACK.—4ft. 8in.
TYRES.—1020 m/m × 120 m/m., or 915 m/m × 105 m/m. Dunlop plain Tyres.
IGNITION.—Bosch dual magneto placed well above frame of chassis
COOLING.—Honeycomb radiator (on trunnions), combined with centrifugal water pump.
GEAR BOX.—Four-speeds, forward and reverse. Gate change operated by one lever.
CLUTCH.—Multiple disc pattern.
TRANSMISSION.—Worm drive enclosed cardan shaft to over axle worm.
BRAKES.—Foot external band on drum behind gear box. Hand, internal expanding on rear wheels.
STEERING GEAR.—Worm, and worm wheel type, capable of adjustment.
CONTROL.—Ignition and throttle levers mounted on steering wheel, Foot accelerator.
PETROL TANK.—Oval, pressure fed, fitted at the rear of the chassis, capacity 14 gallons. Pressure obtained by means of an air pump.
LUBRICATION.—Forced lubrication by means of a gear pump.
ROAD WHEELS.—1020 m/m × 120 m/m Dunlop wire, or Sankey detachable wheels, including spare wheel, or 915 m/m × 105 m/m.
CLEARANCE.—11in.
SPRINGS.—Specially strengthened for Colonial use.
FITTINGS.—Brass or nickel.

PRICES OF COLONIAL MODELS

15/20 h.p.	Touring Cars from	**£558.**	15/20 h.p.	Cabriolet (single) from	**£650.**
17/25 h.p.	„ „	**£618.**	17/25 h.p.	„ „	**£710.**
*30/50 h.p.	„ „	**£1,045.**	*30/50 h.p.	„ „	**£1,150.**

* Six-cylinder model.

N.B.—All prices are for cars delivered at Elswick Works, and do not include freight or packing.

Write for our full descriptive Catalogue. It will interest you.

Sir W. G. Armstrong-Whitworth & Co., Ltd.,
Elswick Works, Newcastle-on-Tyne.

LONDON:
3, Blenheim Street, Bond Street.

MANCHESTER:
114, Deansgate

Palmer Cord Tyres

"The Tyre that is different."

Certain points in connection with the use of Motor Tyres which, from the correspondence of foreign correspondents, appear to be of general interest are briefly touched upon in the following paragraphs.

Competition between car manufacturers to list chassis at what are supposed to be popular prices has resulted in many cars being fitted with tyres too small for the work they are expected to do, a short-sighted policy which frequently proves most expensive to the owners of such cars.

If the tyre bill is to be kept reasonably low, tyres should never be loaded beyond the maximum specified by the tyre makers for the section employed. To comply with this condition the normal load should not exceed 80 % of the carrying capacity of the tyre, leaving a margin of 20 % for the occasions when extra passengers, luggage, or equipment are carried.

A Palmer Cord Tyre, 810 × 90, inflated to a pressure of 80 lbs., will carry a load of 8 cwt. per wheel, but if the normal load on the back axle of a car fitted with this or any other diameter of 90 mm. tyre exceeds 14 cwt., it will be found far more economical to fit the corresponding diameter of 105 mm. section, which is designed to support a load of 10 cwt. per wheel when inflated to 80 lbs. pressure. For an axle load of 16 cwt., the correct pressure for 105 mm. tyres would be 64 lbs. against the 80 lbs. necessary if a similar load has to be carried by 90 mm. tyres.

The 765, 815, 875, and 915 × 105 Palmer Covers may be used on 760, 810, 870, and 910 × 90 rims as well as on the 105 rims. When 105 mm. tyres are used on 90 mm. rims, the security bolts should be of the 90 mm. size; with 105 mm. rims, 105 mm. bolts should, of course, be used.

A Rubber-Studded Palmer Cord Tyre, 30in. × 3½in., is now supplied for Ford and other American cars fitted with American standard rims. The price is the same as the metric size 760 × 90 Ribbed Cover and Tube.

Recommended Pressures and Maximum Loads for Palmer Cord Tyres.

Load per Wheel.	Minimum Inflation Pressure in lbs. per sq. in.						Load per Wheel.
Cwts.	90 mm.	100 mm.	105 mm.	120 mm.	135 mm.	175 mm.	lbs.
4	40	36	32	—	—	—	448
5	50	45	40	35	—	—	560
6	60	54	48	42	—	—	672
7	70	63	56	49	42	—	784
8	80	72	64	56	4[illegible]	—	896
9	—	81	72	63	54	—	1008
10	—	—	80	70	60	40	1120
11	—	—	—	77	66	44	1232
12	—	—	—	84	72	48	1344
13	—	—	—	91	78	52	1456

Load per Wheel.	Minimum Inflation Pressure in lbs. per sq. in.						Load per Wheel.
Cwts.	90 mm.	100 mm.	05 mm.	120 mm.	135 mm.	175 mm.	lbs.
14	—	—	—	98	84	56	1568
15	—	—	—	105	90	60	1680
16	—	—	—	—	96	64	1792
17	—	—	—	—	102	68	1904
18	—	—	—	—	108	72	2016
19	—	—	—	—	114	76	2128
20	—	—	—	—	120	80	2240
22	—	—	—	—	—	88	2464
24	—	—	—	—	—	96	2688

For Prices see advertisement on page xxxv.

The Palmer Tyre, Limited,

119, 121 & 123, Shaftesbury Avenue, London, W.C.

Telegraphic and Cable Address—"TYRICORD, LONDON."

EISEMANN PLUGS

are the result of years of experience and experiment, and can be bought with every confidence.

A particularly hot spark is obtained even at slow revolutions or with a dirty engine where other plugs refuse to work.

A slow, silent, and easy running engine when throttled down.

The highest possible resistance to soot and oil. A durability hitherto unattainable, particularly at the sparking points, which are almost everlasting, and require no resetting.

In all cases where waste of current, bad starting, and other ignition troubles are complained of Eisemann plugs should be used.

EISEMANN

MAGNETOS & PLUGS.

EISEMANN MAGNETOS

are made in all types suitable for all types of engines. We were the earliest makers of magnetos, and after many years of experience our latest designs of magnetos are of the simplest possible character. We have the fewest possible working parts. and we claim that our machines will stand the most severe tests of the modern automobile engine.

Full particulars of Eisemann ignition apparatus on request.

THE . .
EISEMANN MAGNETO CO.,
43, BERNERS ST.,
OXFORD STREET,
LONDON, W.

Telephone: No. 4601 City.
Telegrams: "Rousillon, Ox, London."
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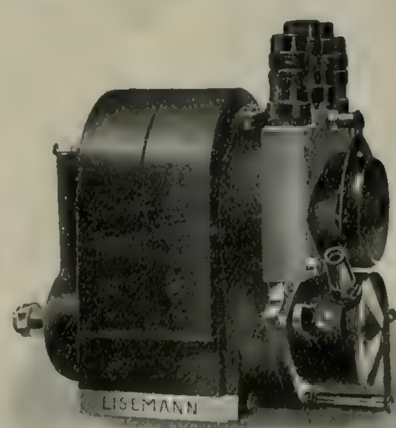
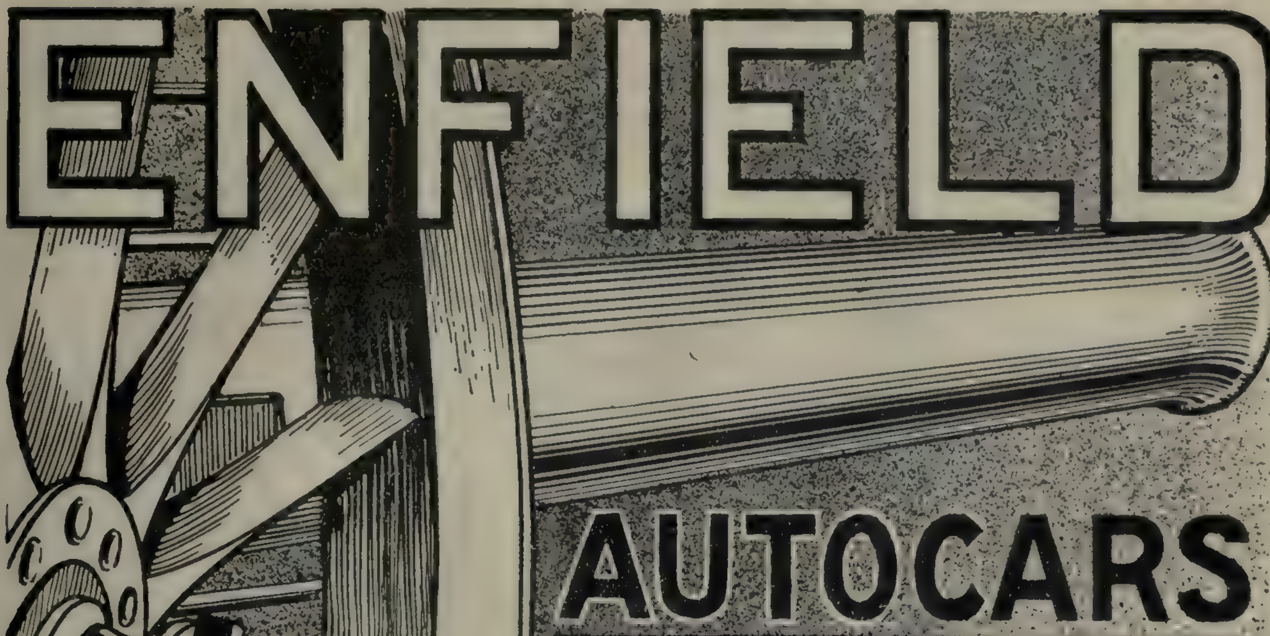
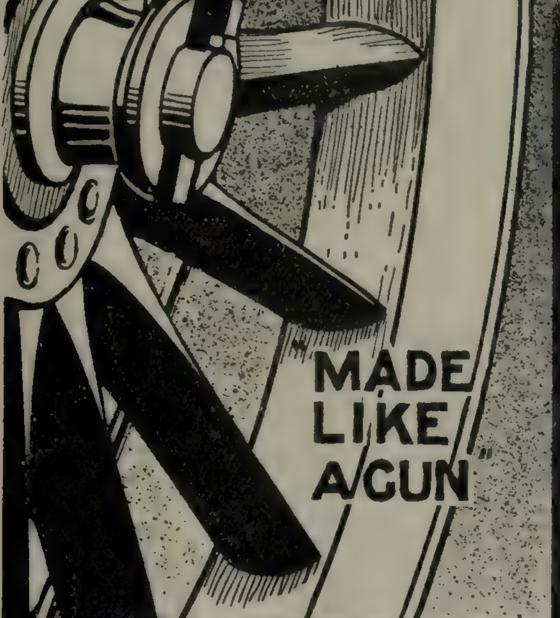


C.D.C.





TO MOTOR CAR DEALERS
ALL-OVER-THE-WORLD.

Gentlemen,

Will you permit us to send you particulars of our latest models and evidence of the splendid results our Cars are giving both at home and abroad?

Colonial conditions have been particularly studied in our latest designs, and we claim that among Cars of highest quality there are none so moderate in price.

By careful attention to our Customers' requirements, and expert personal attention to their commands, we have succeeded, within a short period, in more than doubling our Export Trade.

Write us to-day. Whatever Cars you may be handling at present it will interest you to see our Catalogue. It will be sent post free on request.

Yours faithfully,
THE ENFIELD AUTOCAR CO., LTD.,
ENFIELD WORKS, SPARKBROOK,
BIRMINGHAM, ENG.

1913 Models

And prices at Works (Birmingham).

Up-to-date in all respects, and absolutely highest grade. British made throughout.

14·3 h.p.,	76 × 120, four speeds, complete car, from	**£315**
18·4 h.p.,	86 × 130, four speeds, complete car, from	**£350**
24·9 h.p.,	100 × 130, four speeds, complete car from	**£400**

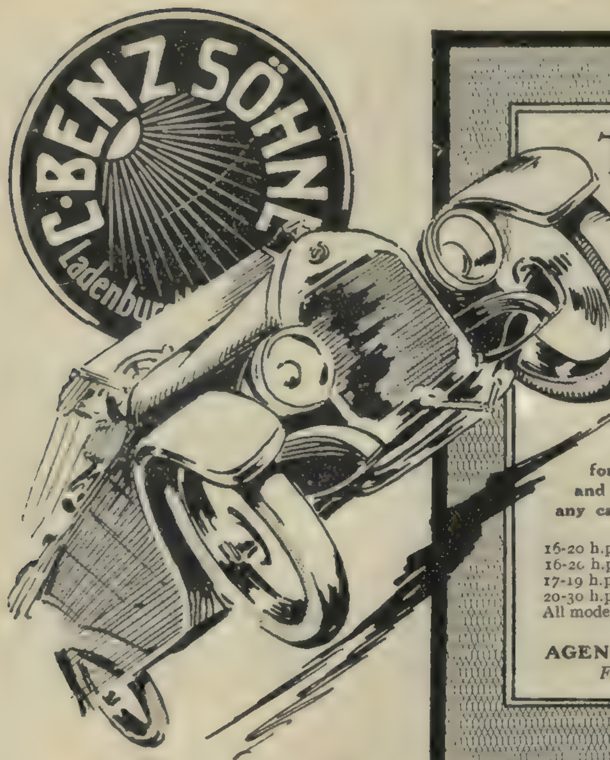
Or fitted with **Enfield Self-Starter £15 : 15 : 0 extra.**

THE ENFIELD "AUTOLETTE," 8 h.p.,

water cooled, three speeds, worm drive Price, with full equipment .. .. **£138 10s.**

The Finest four-wheeled runabout on the market.

A PERFECT "LIGHT CAR."



THE CAR THAT HAS · · · · LEAPED INTO FAME

by sheer merit, because only the best materials, the highest grade workmanship, and the most up-to-date ideas find their way into its construction.

BENZ-SÖHNE

"THE HIGHWAY KING."

Built for hard wear on any roads. There is positively nothing on the market to compare with the BENZ-SOHNE for quality of materials and workmanship, nor for speed, power, and flexibility. It represents the highest value obtainable in any car irrespective of price.

1913 MODELS AND PRICES.

16-20 h.p. (80 x 130 mm.)	9ft. 8in. wheelbase.	Chassis (with tyres)	£380
16-20 h.p. (80 x 130 mm.)	10ft. 6in. ,,	,, ,	£390
17-19 h.p. (85 x 115 mm.)	9ft. 8in. ,,	,, ,,	£390
20-30 h.p. (90 x 140 mm.)	10ft. 9in. ,,	,, ,,	£525

All models have enclosed valves, silent chain half-time gear, dual ignition and 820 x 120 mm. tyres.

AGENTS WANTED FOR BRITISH COLONIES.

For full particulars apply to Sole Concessionnaires :—

DARBY & WEBER, LIMITED,

118, Great Portland Street - - London, W.

Telphone : 1967 Gerrard.

Komnick

1913 Models and Prices :

12-14 h.p. (70 x 100), 9ft. wheelbase, Chassis with tyres	**£260**
do. do. do. with Torpedo Body	**£300**
16-20 h.p. (80 x 130), 10ft. 1in. wheelbase, Chassis with tyres	**£400**
do. do. do. with Torpedo Body	**£465**
20-30 h.p. (90 x 140), 11ft. 4in. wheelbase, Chassis with Tyres	**£475**
do. do. do. with Torpedo Body	**£570**
30-40 h.p. (100 x 140), 11ft. 4in. wheelbase, Chassis with Tyres	**£550**
do. do. do. with Torpedo Body	**£650**
30-60 h.p. (105 x 160), 11ft. 6in. wheelbase, Chassis with Tyres	**£675**
do. do. do. with Torpedo Body	**£775**

Agents now being appointed for British Colonies.

Write for full particulars to Sole Concessionnaires :

DARBY & WEBER, Ltd.,

118, Gt. Portland St., London, W.

'Phone 1967 Gerrard.

The Best Car for Colonial Roads.

The KOMNICK is a high grade, dependable touring car. Accessible, simple, and built to give service that is bound to satisfy the owner. During the past two years KOMNICK cars have been most successful in all competitions, winning **10** First Prizes, besides Gold and Silver Medals, Shields of Honour, etc., etc. In the Emperor's Tour, 1911—St. Petersburg, Moscow, Sebastopol—three KOMNICK cars completed the journey without loss of a single mark. An unparalleled feat of endurance and consistent running.

30-40 h.p. KOMNICK.


SMITH'S "PERFECT"
SPEEDOMETERS
THE NAME ON THE DIAL IS THE HALL MARK OF QUALITY
STEADY AS A ROCK
PROOF OF EXCELLENCE
175 CARS AT OLYMPIA WERE FITTED WITH SMITH'S ROCK STEADY PERFECT SPEEDOMETERS
101 CARS WITH ALL OTHER MAKES OF SPEEDOMETERS
Price from £3·10·0
S. SMITH & SON Lᵀᴰ 9 STRAND · LONDON ·

MORRIS, RUSSELL & Co., Ltd.

SPECIALISTS IN HIGH-CLASS
BRITISH AND AMERICAN AUTOMOBILE ACCESSORIES.

A FEW FORD, HUPP, AND FLANDERS FITMENTS.

The Famous "K-W" FORD LIGHTING SETS.

derive their current from the existing Ford Magneto and enable you to obtain a brilliant light on the road, just when you want it, without any trouble beyond touching the switch.
The current COSTS YOU NOTHING, and beyond a new bulb occasionally the upkeep is NIL.
The lamps are supplied complete with Bulbs, Wiring and Switch, and can be fitted without tools in a few minutes. They just drop on to the existing Ford Brackets.

BULLET PATTERN. The Set comprises a pair of Head Lamps, 2 Bulbs, Switch, and Wiring complete.

	Inclusive price	Code Word,
All Brass finish	**£4 4.**	'Fordlette.'
Black and Brass ..		'Fordack.
Spare Bulbs. 6 v. 12 c.p. ..	3/- each ..	'Fordst n.

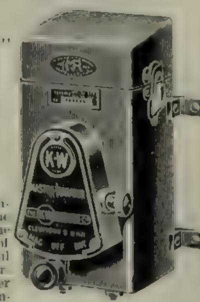
The "KINGS" MASCOT.

As fitted to the CAR of H.M. KING GEORGE V.

Hand chased. Exquisite design.

PRICES.		Code.
BRASS	£1 1 0.	"Kingly."
NICKEL PLATED	1 5 0.	"Kingdom."
SILVER PLATED	1 10 0.	"Kingship."

The "K-W" Master Vibrator

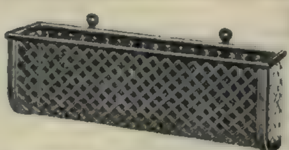


takes the place of the four separate Tremblers on the Ford Coil. It steadies the ignition, cures misfiring, and increases the power and speed of the car. The use of the Master Vibrator has been so successful that we are prepared to refund the purchase price to any dissatisfied customer who returns the Vibrator, in good condition, within 30 days of delivery.
"Good ignition means not only a hot spark, but a hot spark properly tuned

Recommended by all the leading 'FORD' Agents.

New Reduced Price £3 10 0 Code Word—'Ma-ator

The "Eros" Odds and Ends Rack.



Length 12in.
Depth 4¼in.
Width 8in.
The handiest fitting on the car.
A strong metal basket for the dashboard or interior of car, forming the most convenient receptacle for gloves, road map, pipe or tobacco pouch.

Brass. Nickel Plated. Copper Oxidised—**12/6.**
'Oddity' 'Oddness' 'Oddling' Any size to order

For Every kind of road the "Woodworth"

Treads are the only effective Non-Skids. They are held in position by strong coiled steel springs at each side, and do not heat or chafe the tyres.

They are absolutely Puncture Proof
Your present back tyres are only non-skids so long as the rubber studs project. The Woodworth Treads are steel studded and are non skids all the time.

REPRESENTATIVE PRICES.	Each	Code Words.
750 x 85	44/-	"Garcia"
30 x 3	45/	"Famoso"
760 x 90	51/-	"Gazozo"
30 x 3½	51/-	"Febraca"
31 x 4	75/-	"Fencore"

Over 100,000 sold during the last six years. Made in 50 Sizes.

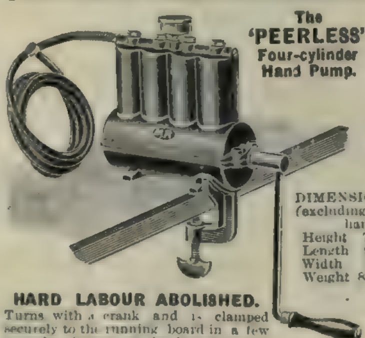
The BEST PLUG for FORD, HUPP, and FLANDERS CARS is undoubtedly the "CHAMPION X"

as it is so easily taken apart for cleaning.
Price 3/- each. Code: 'Champs Spare Porcelains' 1/6 each, Code: 'Champorce.'

Enables Petrol to be instantly injected into the Engine for easy starting.

The New "CHAMPION" Priming Plug is as effective as a **Self-starter.**
Price 6/- each
Code Word—Primus.

The 'PEERLESS' Four-cylinder Hand Pump.



DIMENSIONS. (excluding handle.)
Height 7¼in.
Length 9 in
Width 8 in.
Weight 8¼lbs.

HARD LABOUR ABOLISHED.
Turns with a crank and is clamped securely to the running board in a few seconds. Pumps up the largest tyre to full pressure easily and speedily
PRICE. complete with gauge. **£3 3s.** Code—'Peerless.'

The "GLOBE" STEEL BOX

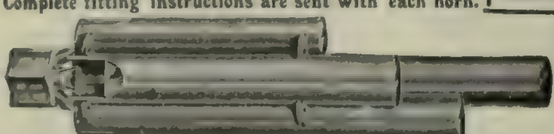
makes a handsome addition to the Running Board of the Car. Finished in Black Enamel.
For Tools, Battery, Spares, etc.
Prices—
B116. 10¾ × 5¼ × 8¼in **10/6,** Code "Globox."
C166. 15⅜ × 6⅜ × 9in. **17/6,** Code, "Globett."
Made in 26 sizes. Supplied with, or without wood lining.

The AERMORE Exhaust Horn

Produces four different notes simultaneously with a rich ORGAN tone. Self cleaning—cannot clog owing to its unique construction. Can be fitted on Running Board or at back of car. Fixed to end of Exhaust Pipe (no cutting of pipe required except on motor cycles and cycle cars for which it is only necessary to cut a hole in the exhaust.

PRICES, COMPLETE WITH FITTINGS.		Code.
No. 1. Size for cars over 35 h.p.	£2 15 0.	"Aermell."
,, 2. ,, ,, ,, ,, 25 h.p.	2 10 0.	"Aermist"
3. Size for 'Ford,' 'Hupp,' and 'Flanders,' and all other cars up to 25 h.p. . . .	2 2 0.	"Aermo."
4. Size for Cycle Cars and Motor Cycles.	1 10 0.	"Aermite."

Complete fitting instructions are sent with each horn.



The 'KALES-HASKEL' Mirrors

are the BEST for all AMERICAN CARS.
Very strong, beautifully finished.
PRICES:
BRASS **10/6.** 'Kaleston'
PLATED **12/6.** 'Kaleskel'
Fixed in a moment to the frame of Screen.

INSIST ON "MOTORBESTOS" LININGS for FORD, HUPP, and FLANDERS CARS.

Supplied either with or without Brass Wire Insertion for Ford Cars.
Motorbestos is noted for its Durability, Gripping Power, and Sweetness of action. Brakes lined with Motorbestos always grip, and when your brakes are shod with it you can travel with perfect security. Ford Cars require 23ins. of 1⅛in. x ⅛in Price per length, **3/6.** Or **1/10** per foot. **Hupp Cars** require 2in. × 5/32in at **3/4** per foot **Flanders Cars** require 2in. × ⅛in., at **3/2** per foot.
Stocked in scores of sizes for every make and type of car.

Sole Distributers for Europe and British Colonies **MORRIS, RUSSELL & Co., Ltd., 6, Gt. Eastern St., London, E.C.** Trade Marks: MR and Eros.

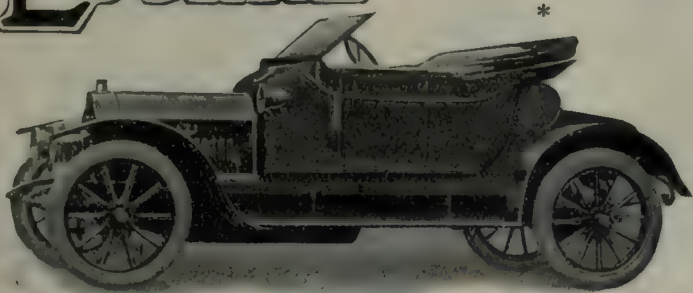
Motor Accessory Merchants Manufacturers' Agents.
Telephone—London Wall 7601. Codes A B C 5th Edition and Western Union. Cable Address—"Luminously, London."
Australasian Agent—W. G. HANDCOCK, 423, Wellington St., Clifton Hill, Melbourne. S. African Agents—SMITH, DENHAM & Co., P.O. Box 2930, Johannesburg. Federated Malay States Agents—BERRY & Co., Ipoh, Perak

INDENTS THROUGH HOME SHIPPERS PROMPTLY ATTENDED TO.

14 h.p.

LICORNE

FLEXIBILITY
ECONOMY
SILENCE
POWER



*

Body Type T5

Code "Ganer."

(*See specification below.*)

Royal Albert, Silvertown,
October 7th, 1912.

Dear Sirs,

In answer to yours re the LICORNE CAR you supplied me with, I must say that I am highly pleased with it and have had a good tour through Kent up very nasty hills, and the car has gone up without the least trouble, and have had no trouble with the engine whatever, and it is a Car I should recommend to any of my friends whoever thought of going in for motoring.

Yours truly,
J. N. STEMP.

14 h.p., 4 cyls., 75 × 120, Two-seaters, from £235, complete with Side and Tail Lamps, Tool Kit, Jack, Pump, and Number Plates.

Other models—14 h.p. and 18 h.p. chassis, 4 speeds, gate gear.

£275 *

F. W. BERWICK & CO., Ltd.,

18, Berkeley Street,

LONDON, W.

CHASSIS TYPE	B X 3 Popular Model	B X 4
Power	14 h.p.	14 h.p.
Motor	75 x 120	75 x 120
Lubrication	Pump	Pump
Magneto	Bosch	Bosch
Carburetter	Zenith	Zenith
Gear Type	Quadrant	Gate
Speeds	3	4
Back Axle	Standard	Standard
Bonnet	Straight	Taper
Tyres: Plain Tread Dunlop	800 x 85	810 x 90
Chassis with Tyres	**£210**	**£240**
Codes	Chastyre	Beefor
SIZES: Wheelbase	9ft 2in.	9ft. 2in.
Track	4ft. 2in.	4ft. 2in.
Body Space	7ft. 5in.	7ft. 5in.
COMPLETE CARS.		
"Popular" 2-seater	**£235**	**£265**
Code	Galax	Hert
Hood for ditto	**£5**	**£5**
Code	Cood	Cood
Screen for ditto	**£3**	**£3**
Code	Folg	Folg
T5. 2-seater with hood and screen as illustrated above.*	**£275***	**£305**
Code	Ganer	Ganis
T8. 4 or 5-seater Torpedo, with hood and screen as illustrated	**£310†**	**£340**
Code	Teeate	Beight
Riley detachable wire wheels and spare wheel	**£16 10 0**	**£16 10 0**
Code	Rye	Rye

TESTIMONIAL.

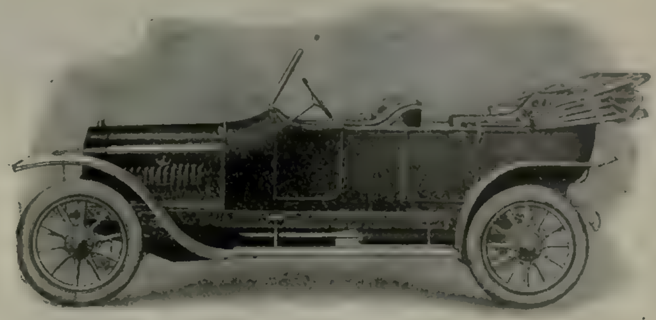
14, Augusta Street, Birmingham.
20th February, 1913.

Sirs,—When just over 12 months ago you supplied me with a 12-14 h.p. Licorne Car, I promised that when a year had elapsed I would let you know how my experience compared with what you told me concerning the Car.

I think you were too modest. I have driven over 10,000 miles in the 12 months and am simply delighted with her reliability of running and economy of upkeep. The only replacement has been four sparking plugs. My general average in petrol consumption is 25 miles per gallon, but long journeys 28. My present rear tyres have done 7,000 miles and I propose changing them to the front, where I estimate they will be good for another 2,000 before re-treading. The car has not given me a moment's trouble, and is regular in its running, and as I use it for commercial purposes and carry a good load of heavy samples out in all weathers and over all conditions of roads, I consider she has passed through with flying colours. The control is simplicity itself, and her silent running and the way she pulls on hills is a marvel.

In my opinion the Licorne is the best light car on the market, and to re-echo the opinion of all who have been in mine, from the novice to the expert—"She is a wonderful little car." If you care to make any use of this letter, you have my permission to do so.

Yours faithfully,
(Signed) MARINO N. CLADDO.



14 h.p. B X 3 Chassis. T8

4-seater Torpedo Body, Hood and Screen - £310 †

Code "Teeate."

K-R-

The Sun Never Sets

K-R-I-T Cars are in daily use in every quarter of the globe, giving car for service overseas, because of its extreme hardiness and its

MODELS AND PRICES.

Five Seater,
200 GUINEAS.

Two-Seater,
200 GUINEAS.

Chassis,
£180.

Delivery Van,
200 GUINEAS.

Coupe,
£285.

Landaulette,
£300.

Cabriolet,
£325.

London Built Bodies.
Colour and Style to choice.

K-R-I-T TWO-SEATER MODEL de LUXE with hood, screen, 5 lamps, generator, detachable rims, including spare rim and tyre, fitted with waterproof trunk at rear and every accessory. **PRICE 200 GUINEAS.**

K-R-I-T LANDAULETTE. A smart elegant town carriage, remarkably silent and flexible, and light on tyres, completely equipped. Ready for the road, £300.

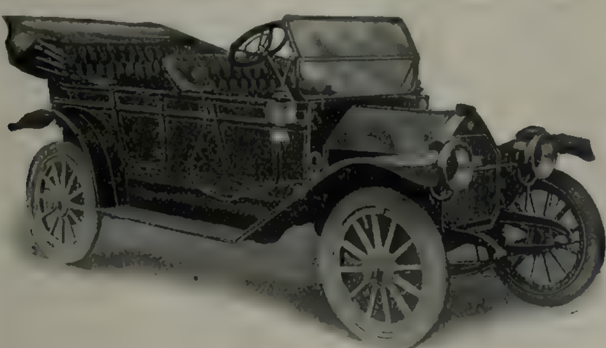
Telegrams—"Juniotav, London." **THE KRIT MOTOR CAR Co., Ltd.,**

The value in

I-T-

on the K-R-I-T Service.

comparably reliable service to their owners. The K-R-I-T is the very
bility to withstand rough usage in travelling over Primitive roads.



K-R-I-T FIVE-SEATER TOURING CAR. with hood, screen, 5 lamps, detachable rims, including spare rim
nd tyre, and all accessories. Ready for the road, PRICE 200 GUINEAS.

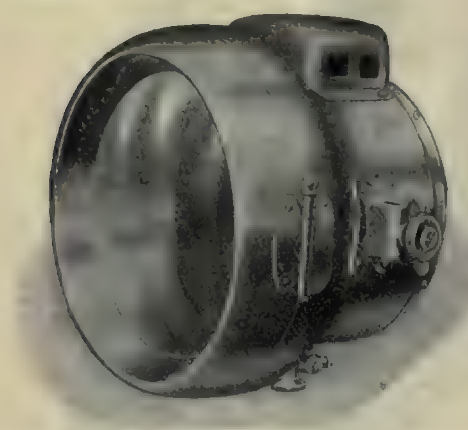
K-R-I-T DELIVERY VAN. A smart economical vehicle replete with every equipment. Ready
or the road, 200 GUINEAS.

127, Long Acre, London, W.C. Telephone—
5011 Gerrard.

Why not investigate the reliable K-R-I-T? its many improvements and distinctive refinements which have been incorporated, have brought these famous cars to the level of automobiles at double the cost.

Catalogues gladly forwarded to any part of the world.

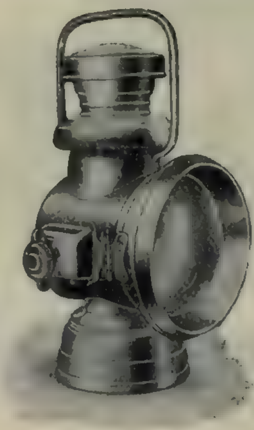
finest the world



Head Lamp .. .. Model 635.

A strong well-made, Acetylene lamp of excellent finish. Has 8in. Front, 6in. Mangin Lens Mirror and adjustable burner for focussing. Bracket centres 7½in. Gives a good, steady light and is thoroughly reliable.

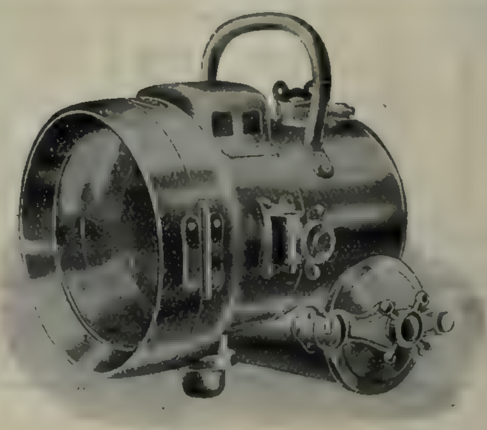
Nickel 45/- .. .. Brass 41/6.



Side Lamp .. Model 540.

A small size lamp, but gives a good light. Height 9in.; 5in. Front. Strongly made and well finished.

Nickel 33/6 .. Brass 30/- per pair.



Head Lamp .. .. Model 500.

A self-contained Acetylene lamp of special design, soundly constructed and excellently finished. Has 7in. Front, 5in. Mangin Lens Reflector and 6¼in. Bracket centres. Can be depended upon to give a good steady light.

Nickel 45/6 .. .. Brass 41/6.

Always use P&H LAMPS

HIGHEST GRADE

— BECAUSE — you can thoroughly depend upon them to always give efficient service — they are moderate in price — economical in upkeep — and only require ordinary attention to maintain in perfect working order.

— Remember, the initials "P. & H." represent the famous Powell & Hanmer productions — the British-Made QUALITY Lamps of "Highest-Grade" and highest VALUE.

— In design, materials, workmanship, and finish, "P. & H." LAMPS typify BEST — our unrivalled experience and knowledge combined with the finest productive facilities make them so.

— Hence, always use "P. & H." LAMPS — you'll then be assured of perfectly satisfactory lighting equipment.

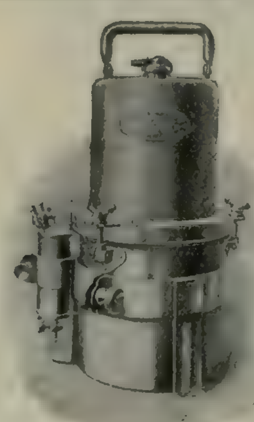
— Our new Electric Lamps, and our many other Models are illustrated in our "Car-Lamp Catalogue." Write for copy post free, it will aid you in choosing.

Powell & Hanmer, Ltd., Chester St., Birmingham.

Head Lamp .. .. Model 600.

Our leading Acetylene model, made upon the latest constructive principle, and excellently finished. Has 8in. powerful Mangin Mirror Reflector, optically ground and correctly focussed. Gives a powerful, concentrated beam of light. 10in. Front, 9½in. Bracket centres.

Nickel 85/- .. .. Brass 77/6.



Generator .. .. Model 640.

Strongly made, of extra large size, has shaking grid to carbide chamber, which ensures greater efficiency. Will supply two headlights for from 5 to 6 hours when fully charged. With Metal Clamp as shown 41/6. Nickel-plated or Brass 45/-. Fitted into a Polished Wooden Box 52/-.

Head Lamp .. .. Model 870.

This lamp has 9in. Front and is fitted with Real Mangin Mirror Reflector, Bevelled Plate-glass Convex Lens and "RONI" Burner. Compact and strong, and gives an excellent light.

Nickel 45/- .. .. Brass 41/6.

R.H.S.

"MOTOR UPKEEP"

AND HOW TO REDUCE IT.

Surely this is a question which must appeal to every Car owner or driver.

We have published a little booklet the title of which is

"MOTOR UPKEEP"

It illustrates, describes, and prices the many Specialities we have introduced for the purpose of eliminating maintenance costs and adding to the comfort of all Car owners and drivers.

"Chemico" Carshine, a metal polish in powder form, soluble in petrol making the finest metal polish it is possible to obtain.

"Chemico" Reliance Patches, of all types, sizes, shapes, etc.

Repair Outfits, Rubber Solution, Illuminating, and Lubricating Oils, Motor Grease, Vasoleum—the only really satisfactory gear-box lubricant—and Scores of other useful lines.

We want to post to every reader of this work a Copy of that booklet HELPFUL, INTERESTING, FREE.

MAY WE POST YOU A COPY?

If so, send postcard. Booklet by return post.

THE

COUNTY CHEMICAL Co., Ltd.

2 Chemico Works

Bradford Street, Birmingham Eng.

LONDON. MANCHESTER. GLASGOW.
DUBLIN. CARDIFF.

37/24/1/13

THOMSON-BENNETT

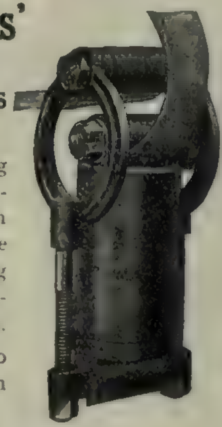
ALL-BRITISH MADE.

'Glissades'

ENCLOSED FRICTIONLESS MODEL.

A true springing device, eliminating friction owing to the swivelling action and absence of guides.

Sensitive to every variation in the load.



NOTE: No Guides to bind.

For Cars up to 20 cwt., **£3 : 10 : 0**

30 cwt., **£4 : 10 : 0**

40 cwt., **£5 : 10 : 0**

Prevent small road shocks from reaching frame.

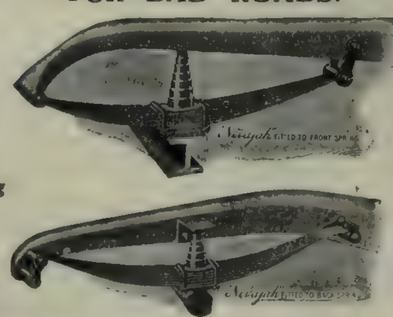
"NEVAJAHS"

FOR BAD ROADS.

Save Springs

Stop Swaying

Easily Fitted.

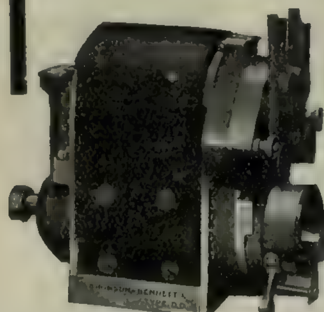


Thousands in use in all parts of world.

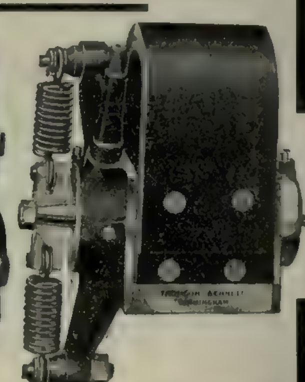
Prevent bad bumping.

For medium cars, 16/6 pair. For heavy cars, 18/6 and upwards.

THOMSON-BENNETT **MAGNETOS** The All-British Machines.



4-cyl. D.D. Type Magneto.



Oscillating Type H.T. Magneto.

New D.D. Type (dust and damp proof) Magnetos are the last word in high-class up-to-date British manufacture.

For cars, cycles, marine, agricultural, and stationary engines. Special Oscillating Magnetos for slow speed work (gas engines, etc.)

Agents in all parts. Send for Lists.

THOMSON-BENNETT, Ltd., Birmingham.

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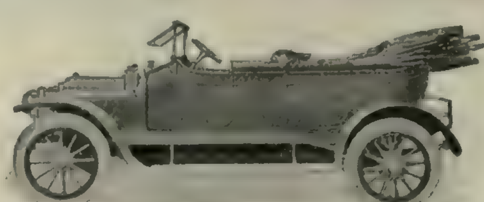

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The Autocar

IMPERIAL YEAR BOOK

1913.

FOR CIRCULATION IN THE COLONIES, OVERSEAS DOMINIONS AND ABROAD.

PUBLISHED ANNUALLY BY—

ILIFFE & SONS, LIMITED, 20, TUDOR ST., LONDON, E.C.,

ENGLAND.

PREFACE.

THE main aim of this work is to put into a convenient form, for the benefit of readers beyond the seas, a volume of information on motor subjects which will keep them up to date; in other words, the attempt is to provide a review of automobiles and automobilism as they stood at the opening of the year.

For some time past it has been felt that the need existed for such a compilation as "The Autocar Imperial Year Book," and the endeavour has been to compile a standard work of reference for the use of motorists abroad and the many intending users who desire a means of making reliable comparisons of cars and accessories before purchasing.

A glance at the contents on the next page will show the wideness and scope of the book. The effort has been to make it of use and interest, not only to those who want to know about technical aspects of the subject, but also to those who are interested in it either from a business or a recreational point of view.

The compilation has mainly been carried out by men who have personal knowledge of Britain beyond the seas. They have endeavoured to keep in mind the things which those who are separated from the motor manufacturers by long distances, and consequently long time intervals, most wish to know, and they will be grateful for any criticisms which will enable them to make future editions of the work more useful.

CONTENTS.

(A full index will be found at the end of the Editorial Section.)

The Modern Chassis: Tendencies of Design.

1913 Practice and Tendencies as Exemplified by the Exhibits at the last Olympia Show, together with some Criticisms.

(*Coachwork is reviewed on pages* 9-18).

Engines.—Two rather noticeable tendencies in engine size are to be found when taking the exhibits as a whole. On the one hand, the 80 mm. engine has been increased in size, in some cases by lengthening the stroke; in others it is no longer in the 80 mm. class at all, for, while retaining quite a moderate stroke, it has been increased more or less in bore, though, unquestionably, the more frequent enlargement has left the bore alone and added to the stroke. This is a perfectly natural consequence of the overloading of the average 80 mm. engine, *i.e.*, of engines of 80 mm. bore or thereabouts and not exceeding 120 mm. stroke. These engines were so remarkably efficient with reasonable loads that both makers and users alike, as we pointed out last year more than once, began to expect too much of them and to overload them, so that they could only make a reasonable average speed on the road by being geared very low, and they therefore became more or less irksome to drive. This matter began to correct itself last year, when a good deal of stroke lengthening was done, but this year it has become much more general. In saying this it should be understood we are dealing with those 80 mm. engines which are expected to do work and to make averages as high or higher than were required only a very few years ago from very much larger engines.

Side by side with this very strong tendency to enlarge the capacity of the 80 mm. engine there is an almost equally noticeable tendency to build still smaller engines than have ever been constructed before, except in exceptional cases. There is now quite a large class of engines of about 70 mm. in bore for small light four-seated cars, but the matter does not end here, as there is a still smaller class—smaller in both senses of the word at the present time, but none the less existent—in which the engine is of less than 60 mm. bore. Strangely enough, in these days of long strokes the majority of these small and very small engines have not relatively long strokes, though there is at least one engine of 50 mm. bore which has a stroke of double its bore, and there are other small engines of approximately similar stroke-bore ratio.

As to the tendency which was so noticeable last year to lengthen the stroke without touching the bore, this has, unquestionably, become very much stronger; indeed, it is a question whether it has not been overdone in some cases, though with the knowledge available at the moment, we certainly should not like to say that any car in the exhibition was really too long in the stroke: what we do wish to infer is that the stroke-bore ratio has probably arrived at or near its extreme, as may be imagined when we find strokes of two and a quarter times the bore. Such a ratio approaches within measurable distance of the 80 × 200 mm. record breaker which gave the old Brooklands rating classes their death blow and brought about the institution of the far more satisfactory capacity rating now established.

A cursory inspection of Olympia might lead to the conclusion that for propelling a given load engines were becoming smaller, and, while it is true that the monster slow-running engine is now a thing of the past, we should certainly say that the all-round lengthening of stroke has checked the tendency towards the very small engine for cars of medium size and weight, though side by side with this there is the growth of the smaller classes of engines in cars which are properly within their power. This is satisfactory, as against the small engine, because it is small, nothing can be urged. It is the calling upon it to propel cars too big for it which is objectionable.

Cylinders.—There is no universal practice in regard to the casting of cylinders, though the use of the *monobloc* casting for the four-cylinder engine and the two groups of three for six-cylinder engines is growing. The few who cast their cylinders individually have not departed from their well-established practice, but a good many of the makers who have hitherto cast them in pairs are now casting them in the single block. The very satisfactory, though more expensive, system of casting in pairs and then bolting the two together in such a way that they become to all intents a *monobloc* is still only practised by one firm, though there is not a little to recommend it, and there are possibilities in this direction which have not yet been pursued to their full development.

The design of *monobloc* castings has improved, as we suggested a year ago would be the case. At the same time, there are still a good many castings in which the desire to eliminate outside piping generally has led to what is, we are bound to say, a more or less choked engine. Not a little of the improvement in the *monobloc* casting design has come about through an increase of skill on the part of the founders of these often very difficult jobs, and a fuller realisation on the part of the designers as to what is reasonably possible and impossible in a casting. There is a pretty general consensus of opinion that, quite apart from providing a very rigid engine, the *monobloc* casting is cheaper from the manufacturer's standpoint. The average repairer, both amateur and professional, still prefers the cylinders to be cast in pairs, even though it may mean the breaking of a joint or two, as he finds them easier to handle when the cylinders have to be drawn for engine cleaning or attention given to piston rings and gudgeon pins. At the same time, the repairer no longer regards the *monobloc* casting with the horror he once did, and no doubt his work can be greatly facilitated when the cylinder barrels are chamfered away at the bottom so that an easy entry of the pistons with their rings is ensured.

This brings us, perhaps, to the most disappointing feature: the lack of consideration of the user which is shown in regard to the cars for 1913. With one or two notable exceptions not the least attempt has been made to render it any easier to clean the top of the piston and the combustion head, and ninety-nine engines out of a hundred can only be cleaned by taking out the valve caps and poking about inside with all sorts of specially contrived scrapers, by taking the cylinders off altogether, by recourse to the oxygen process, or by using a chemical preparation.

Number of Cylinders.—The single-cylinder engine is almost extinct, and it will soon be absolutely so except for runabouts of the most modest description. In many cases, too, the two-cylinder engine has been relinquished in favour of the four for cars in which

the chassis remains practically unaltered. It requires little foresight to prophesy that, speaking broadly, the small car and the medium-powered car of the future will have four cylinders. As to the three-cylinder, it is absolutely extinct, and must be written down as one of the most disappointing engines in the history of motor engineering. Though it may yet come into its own, it appears it will only do so at the same time as the two-stroke cycle is brought to such a state of perfection that it replaces the four-stroke.

So far as British cars are concerned, it may be said, speaking broadly, that if the power required necessitates an engine of much above 100 mm. bore and 140 mm. stroke the tendency is, undoubtedly, to use six cylinders of smaller individual dimensions. There are notable exceptions, but they are in the minority. On the other hand, foreign practice does not seem to have quite the same limits, as abroad, speaking generally, the cylinder unit becomes considerably larger before recourse is had to two extra cylinders.

It certainly cannot be said that the six-cylinder engine is spreading downward, as it seemed likely to do at one time, this undoubtedly being due to the immense improvements which have been made in refining the running of the four-cylinder engine, these improvements not only including the engine itself, but also that vital organ, the carburetter.

In a sense, the higher powers of four and six-cylinder engines appeal to two different classes. The covered-car owner, who requires silence of operation above all things, in many cases is attracted by the six-cylinder engine, which is not only smooth running in itself as a prime mover, but, owing to its more nearly continuous torque, makes gear changing still less necessary than with the four-cylinder engine. On the other hand, the four-cylinder engine appeals to the man who appreciates efficiency in the volumetric sense; he knows that for a given capacity a four-cylinder engine will develop more power besides providing a lighter and simpler motor. It is true he may seldom, or never, call upon his engine to develop that maximum which, volume for volume, would give it an advantage over a six-cylinder engine, but he does not mind if he has occasionally to change gear, and, therefore, all things considered, he prefers the simpler expression.

Poppet Valves.—To look at the valves of to-day and those of three or four years ago, the average, or even the exceptional, man would perceive no difference, but, if he carefully studied cam contours, quality of material and accuracy of workmanship, he would find differences, the dimensional ones being almost infinitesimal, but the effect in operation simply wonderful.

The sleeve valve has done more for poppet valve refinement than it is possible to realise, and even with engines which have quite large valves and high lifts, the quietness of operation is such as would have been regarded as impossible only a couple of years ago. Yet, as we have said, it is only by actual trial that the differences between the valve gears of to-day and those of yesterday can be appreciated. Only two years ago it was regarded as quite impossible to combine in one engine touring smoothness with something very nearly approximating to competition efficiency, but this has now been done by several of the more advanced manufacturers, and quite lively cars can be bought which are none the less smooth and quiet in running, though here again we must give the carburetter its share of the credit.

The practice of closing in the valve gear by readily detachable plates has become almost universal, and, while it has little or no direct bearing upon noise, it unquestionably tends to maintain silence, as the valve motion is not exposed to dirt and the tappet guides may be allowed to take more oil from the crank chamber without making a dirty engine; the consequence is that the covers do tend to maintain silence. In one make this covering of the valves has been carried much further (Bianchi), and the crank chamber has been extended so that the valve tappets, stems and springs, are actually within it. Detachable covers are provided in the sides of the upwardly extended crank chamber, so that the valves are almost, if not quite, as accessible as usual, and we have what we have never had before, and that is a completely lubricated poppet valve system, as it is obvious that not only are the tappets as well as the cams perfectly lubricated, but the valve guides too, which have hitherto been the one unlubricated portion of the motor car engine, and have had more to do with wear and consequent noise in the valve gear and with bad carburation than has usually been recognised. While not wishing in any way to detract from the credit due to the makers, we may mention that this enclosing of the valves in the crank chamber is no novelty, as it has been used on internal combustion engines for marine work with every satisfaction.

While the vast majority of engines are of the one-sided type, *i.e.*, with all the valves on one side, the T-headed engine is very far from falling into desuetude; more than one new design this year has returned to the old practice of having the exhausts on one side and the inlets on the other, and we should not be at all surprised to see this tendency grow stronger now that the silent chain drive has come into such general use.

Valve Drives.—The chain-driven valve shaft has come into much wider use—in fact, its adoption bids fair to become general—but we must say that, so far as we personally are concerned, the absence or presence of a chain-driven valve shaft would never have very much influence upon our choice of a car. Indeed, so long as we had good helical gears we should be as well satisfied one way as the other, though we admit that from the manufacturer's point of view, and the repairer's point of view, there is very much to be said in favour of the chain system. It has, undoubtedly, tended to quietude of engine running, and it may be said to provide a naturally quiet drive, whereas the spur gear drive is not naturally quiet; very great care has to be taken in manufacture to get it quiet, and that care does not cease with the manufacture of the parts themselves: there is often a great deal of trouble after they have been assembled. On the other hand, the chain is a drive which, given accurate work, will be practically noiseless, and, moreover, after long wear, when the main bearings are adjusted, its quiet running will not be impaired.

Many of the chain-driven valve systems now have proper forms of adjustment, more often than not through sliding the magneto, but other makers who started without adjustments still have none, and inform us that they have had no trouble, as, so long as the chains are properly run in and given their initial stretch before being fitted, they will run for many thousands of miles without requiring adjustment, and it is maintained that by the time they do require it they are better for renewal. On the whole, however, we think the evidence available is in favour, and rightly,

of provision for adjustment, but provision should also be made for adjustment of the timing of the valves, as in the case of the Crossley, Vauxhall, and some other cars.

Non - poppet Valves.—No new systems of non-poppet valves were to be found at the last Olympia Show, so that there is no non-poppet valve which has not passed through a year's use in the hands of its owners; the Knight system is now four years old from the user's point of view, and the Argyll, Darracq, and Itala are a year old. Each one of them is silent in operation, and appears to be giving satisfaction to its owners. The Hewitt appears to be no longer made, but this is not on account of any inherent defects of the piston valve. Other firms than the original exponents are taking up both the Knight and Argyll systems, and the state of affairs we suggested as likely about two years ago has arrived; that is to say, while the poppet is no longer regarded as the one and only possible system, the double-sleeve, single-sleeve, and the rotating types are all recognised as good systems. The poppet, while robbed of its ancient monopoly, is still vastly in the majority, and, so far as present indications can show, appears likely to retain this majority.

There is no evidence of any burning desire of the makers generally to secure a non-poppet system at all costs. Undoubtedly, the final valve gear has yet to be evolved, as it will combine the advantages of each system without the drawbacks of either. When this ideal comes about, as it must eventually, the valve question will probably be settled, unless, indeed, the two-stroke cycle in one of its simplest forms should altogether abolish valve gears as we know them to-day. However, our mission at the moment is to deal with the present and the immediate future, and not to attempt to penetrate into that which may lie far beyond it, or *per contra*, may be much closer than any of us imagine.

Before turning from the non-poppet valve we should like again to give credit to the Knight for the wonderfully refining effect it has had upon the poppet valves and their drives, for it must be borne in mind that not only is it almost entirely due to the double slide valve that poppet valves have been rendered so quiet, but simultaneously with its blow at conventionality so far as the valves were concerned, it also brought in the silent chain drive.

Crankshafts and Bearings.—Probably there is a limit to the strengthening of the crankshaft, but, despite the general thickening up of crankshafts last year, even those makers who thought they had done enough have in many cases gone a stage further this year, as they have found the stiffening of the shafts has been so satisfactory that they have still further increased diameters. And in addition there is no doubt that the Norton rotating balancing machines, which Messrs. Alfred Herbert introduced into this country, have done much to demonstrate to the utmost the importance of having a crankshaft which does not react or "whip," if it is desired to secure a smooth-running engine which will be devoid of harsh-running periods, covered under the term of periodicity.

Necessarily, with the increase of shaft sizes both main and big-end bearings have been increased in diameter, though from a purely bearing point of view this is increase in the wrong dimension, as it is length which is really required and in which some bearings are still on the meagre side. As to whether three or five bearings are better for a four-cylinder crank, or seven than four for a six, designers are divided, though, on the whole, the tendency appears to be towards the smaller number of supports in each case.

We think there is still something to be done in the way of stiffening the supports of the bearings themselves, and that a good many designs might be improved by strengthening the upper half of the crank chamber and by placing the bolts more scientifically.

Pistons and Connecting Rods.—The practice of carefully weighing and equalising all pistons and connecting rods is growing, and in these days of comparatively low gears, and, therefore, high engine speeds, it is most desirable.

While steel pistons are far from common more are being used, and pistons generally are being lightened and far more scientifically designed. At the same time, speaking broadly, the light piston has not had all the consideration it deserves, but time is rapidly righting this.

Various attempts are being made to obtain the desideratum of a well lubricated piston, and, at the same time, to avoid penetration of oil above it, as that is, of course, the cause of the greater portion of the annoying carbonising of the piston and combustion head, which so quickly spoils the running of the well-tuned engine. Probably the two most successful attempts are those of the Talbot and Wolseley firms embodied in their 1913 models. In the case of the Talbot the three rings are placed below the gudgeon pin, while the Wolseley has its rings in the usual position at the top, but below the gudgeon pin the piston is reduced to within a short distance of the bottom of the piston, at which point it again assumes its full diameter. In the slightly smaller skirt of the piston holes are drilled, so that while the piston is never short of lubricant the passage of oil above it is almost entirely prevented. These two methods are not the only ones by a long way, but we mention them as instances of the efforts which are being made to keep the engines internally clean, and of two widely different ways of attacking the difficulty.

There was one example of aluminium pistons in the exhibition—those fitted to the N.B. engine. We shall certainly watch their performance with interest if only because they remind us of a historic experiment in connection with steam engines well before the birth of the modern motor car.

Engine Lubrication.—As was the case a year ago, trough lubrication is the prevalent system, but there are variations. In principle it is nothing more or less than a regulated splash; its essential difference, apart from the constant level of oil kept in the troughs, from the old splash system is that the big-ends themselves never touch the oil, the dippers, or small projections, at the bottom of each big end serving to catch up the oil and throw it about, though in some cases the dippers are practically scoops, and not mere agitators, so that oil is scooped into the big-end bearing as well as thrown elsewhere. Where the trough systems generally have been improved is in providing a more definite feed to the main bearings than that of splash. Two systems are most prevalent: one is to have small boxes, or catchpits, over each main bearing, so that the oil thrown up all over the engine falls into them and feeds the bearing, and the other is to have a pipe service to the main bearings from the pump and then to use trough splash for the big-ends and rest of the engine.

Internal lubrication throughout from main bearing to crank pin, and thence to gudgeon pin, is by no

means generally used. There is much to be said in its favour, and not a little against it. The points usually urged against it are that if there be any dirt in the oil it is forced into the bearings, and that, further, if any bearing wears unduly it gets more than its share of oil to the starvation of the rest of the engine. This second objection can be overcome by having a sufficiently high pressure, though, *per contra*, it intensifies the first.

Such extraordinarily good results are being obtained from the better systems of trough lubrication or very near equivalents to it that it seems almost unreasonable to cavil at it. At the same time, we cannot help thinking that, considered from every point of view, the really best system is the internal pressure throughout, provided always that the pump is really powerful enough to send the oil throughout the engine even if one or two bearings be a bit slack, and further, that the filtering arrangements are above suspicion. The very fact of these two conditions being essential is, perhaps, the strongest argument that can be adduced in favour of the simpler trough system; both it and the filters can be more nearly neglected than the more refined internal pressure system. At the same time, in a counsel of perfection it is difficult to avoid the conclusion that the internal pressure throughout is the best of all.

We refer mainly to these two systems because the trough is the most prevalent and the internal pressure the most thorough, but there are a number of variants of both as well as combinations of both, so that the two together may be taken roughly to represent modern engine lubrication.

Probably the part of the lubrication system which, again speaking broadly, is most capable of improvement is the filter. Given proper design of engine and adequate bearing surfaces, so that the actual loads upon the bearings never result in undue pressures, wear would be almost abolished if only the oil could be kept free from grit and other small foreign particles. Nowadays, the motorist who values his engine wastes more oil than he uses; in other words, he empties his crank chamber periodically, and we cannot help thinking that improvement in the filtration system is the line upon which concentration should be made. One great advance has certainly occurred this year, inasmuch as so many more firms are using filters which are really easy to take out and clean. It is obvious that the more easy this operation be made the more perfect the filter can be made, also because the finer the filter be the sooner it clogs, and, therefore, the easier it should be to take it out, remove the impurities it has trapped, and put it back. The readily detachable filter tray beneath the big ends in the Vauxhall unquestionably exhibits a tendency in the direction of refinement of the filtering arrangements, and in providing easy cleansing of the first as well as the second filter, while its generous area is a valuable factor in these days of high pressure and consequent high oil speeds.

Ribbing of the crank chamber and other expedients are being employed to a limited extent to keep the oil cooler, and it is quite possible we may find that racing practice will aid us here, as at least one maker has circulated his oil through a special radiator so as to keep it cool and of good body, which is certainly the most thorough way that has yet been adopted to attack the problem, as all the other devices are but palliatives, and, we are afraid, the majority of them make little more than an imaginary improvement.

Ignition.—Ignition has now become one of the most settled features of the modern engine, and the magneto holds almost undisputed sway. Its only possible rivals are, so to speak, in its own family, and these are, in the first place, the lighting dynamo as exemplified by the Eisemann and Simms combined ignition and lighting machines, and secondly by the electric self-starter, as in the Cadillac, although this last incidentally also comes within the category of lighting dynamos. Still, it is primarily an engine-starter. Entirely separate ignitions—that is, a magneto system and an accumulator and distributer—are rarely found except on the largest and most thoroughly appointed cars, but the dual attachment introduced by Bosch some four years ago is usually fitted to engines of 90 mm. bore and upwards to make starting easier and restarting on the switch possible. It has now been supplemented by a new Bosch device, which consists of a miniature hand-revolved magneto to provide a spark in the cylinders when the engine is stationary, and it is also arranged to work in conjunction with the ordinary running magneto when making the first start with a cold engine, thereby producing a much stronger spark than is otherwise possible, as the baby magneto is geared up. The idea of the supplementary hand-revolved magneto is particularly interesting to us, as we suggested it in *The Autocar* long ago as a combined means of providing not only the equivalent of switch starting, but also as being a convenient way of carrying a spare magneto, as our idea was to have a second full sized magneto, and, of course, the objection to this was on the score of cost. So far as the magneto drive is concerned, it is now as frequently carried out by means of a silent chain as is the case with the valveshaft or shafts.

Carburetters.—In violent contrast to the ignition, which is practically only accomplished in one way, carburation is still carried out by a far larger number of varied methods than any other function connected with the engine. There was quite a number of new and interesting carburetters in Olympia, but it cannot be said that any startling innovations were shown. It is really extraordinary what remarkable results are being obtained by such a variety of widely differing carburetters, but one thing in which they are all similar is that they are all of the jet type with float feeds, the only example of the wick carburetter remaining on the Lanchester car; this carburetter is practically unaltered in principle from the day it was introduced in the last century. If it is borne in mind that the float feed carburetter may have anything between one jet and quite a large number, and yet both give good results, it will be realised how remarkable is the diversity of methods in comparison with the near uniformity of performances. There is no sort of settlement in sight which seems at all likely to bring about a conformity of opinion that single jets or multiple jets are the better. Nevertheless, despite these wide discrepancies, carburation has immensely improved, and the quietness and smoothness of running of the modern engine is as much, or more, due to the improvements in carburetters than to improvements in the engine itself. This is shown by the fact that the running of a hitherto satisfactory engine may be entirely upset by an almost infinitesimal derangement of the carburetter. For instance, an engine which has hitherto run quietly and smoothly will become quite noisy and unpleasant altogether apart from its loss of power by reason of a very slight interference with the petrol supply, such as a partially blocked filter, which may not be anything like enough to bring about an involuntary stop or even materially to affect the speed

and power of the engine; but the very slight restriction will often render the engine comparatively noisy and coarse in its working. It is impossible to consider the carburetter without giving attention to the induction pipes, and there is no doubt that in this respect the tendency to place considerable lengths of the induction branch within the water jacket is good when it is so carried out that free ingress of the mixture is not interfered with, as the heating of the pipe not only tends towards good carburation, but also results in conservation of energy, as it usefully employs some of the otherwise waste heat. It will be noticed that there is a strong tendency more or less to combine the carburetter with the engine, and in several cases, among which the Rover and the Hotchkiss may be mentioned as examples, the carburetter is bolted straight on to the water jacket, and its water jacket is to all intents and purposes part and parcel of the engine, which not only tends to neatness of construction, but a very thorough heating of the mixing chamber, though when this is done care must be taken that the carburetter, and particularly the jet, is accessible, otherwise it necessitates the breaking of a water joint to get at the carburetter. We mean to say there are some designs of carburetters which would not lend themselves to this amalgamation with the engine because their internals are only to be got at by removing the carburetter bodily. This, however, is entirely a matter of design, and does not in any way affect the principle.

Engine Accessibility.—Before passing from the engine and its inseparable companions, the magneto and carburetter, it is perhaps well to consider the vital question of accessibility. Many engines show great improvement in this respect while others appear to be designed without the smallest consideration for the fact that sooner or later it will be necessary to take out the valves or to do one or other of the small jobs which are indispensable to a well groomed engine. To take the most general type of engine (that on which the valves are all on the left side), it appears to us that in many cases quite insufficient use is made of the opposite or blind side. Without going into details, it seems clear that the most accessible combination of the valve-on-one-side type is to have the exhaust pipe on this side swept well up out of the way, the carburetter on the blind side of the engine, and communicating with the inlet ports through the jackets between the cylinders. The magneto (and pump, if fitted) is preferably driven by a cross-shaft in front of the engine, though while this is being done it would often be quite easy to place the magneto considerably higher up than is usual, as while it appears accessible enough in a Show chassis it is often very difficult to get at the points of the make and break and the distributer when the mudguards are in position. Next best to this the magneto should be kept very low and parallel with the crankshaft, it being so arranged that it can be almost instantly taken away from the engine when it requires attention. The idea of it being low down is to keep it quite clear of the valves, and it may just as well be low, if it is once placed at the side of the engine, as it is almost equally inaccessible in either case. But the best position of the magneto from the accessibility point of view is undoubtedly across the engine in front. The arrangement we have roughly outlined above of the engine and its components presents the easiest possible accessibility to the valves, so that when they require attention they can be got at without any difficulty and without the removal of any part not directly connected with them, and each one is equally accessible. This reminds us of a refinement on the Talbot which has its valves covered in, but the casing is so arranged that the two ends after the cover plates have been removed do not get in the way of the hand when one wishes to adjust a tappet or remove a valve. Only a few engines conform to this rough outline of accessibility. Many come within measurable distance of it, but there are others which really are no credit to their designers, as it would appear that the carburetter, the magneto, and even the oil filler itself, not to mention the necessary exhaust and inlet leads, have been put on as an afterthought, everything being crowded on to the valve side of the engine, so that before it is possible to get at the valves one has practically to strip the engine. On the other hand, we find that on the opposite side there is nothing at all—it is an aching void relieved only by the steering box.

Self-starters.—It is impossible in a general article of this sort to deal in any detail with self-starters. This was the first British show in which they were shown in any number, and so far as it was concerned they may be divided into four classes—the atmospheric, the electric, the spring, and the acetylene. There are variants of the first two classes, and we may say for ordinary purposes we regard them as quite unnecessary for the smaller engines except for the use of doctors and others who are constantly stopping and restarting their cars. On the other hand, there is no doubt whatever that with the larger engines they are a great boon, as well as for ladies who are not very strong and who drive without a chauffeur. The objections to them are that they are complicated and more or less heavy, and it appears to us that for many purposes the simpler form of spring starter has very much to recommend it, as it is not only simpler but much lighter. The acetylene self-starter has only one representative, and this is somewhat surprising, as in various forms it is so much used in America.

Undoubtedly in these days of electric lighting the electric engine starter has much to attract, but the pros and cons. between it and the atmospheric starters are quite nicely balanced provided the atmospheric is of such a type that it will start the engine in any position. Where the electric starter scores is in its combination with the lighting system, while the atmospheric claims an advantage, inasmuch as it is available for tyre inflation, and in the case of the Adams for working the jack as well. Credit should be given to the Cadillac makers as the pioneers of the combined system of electric starting, lighting, and ignition.

Clutches.—In dealing with clutches in past years we have said in effect that there was so little between the leather-lined cone, the multi-disc, and the single plate that so long as they were well made they were all practically good in everyday use. This was perfectly true at the time, but it certainly appears to us now that, at any rate for the more moderate powers, the single plate clutch is coming to the front, and wholly and solely upon its practical merits. So far as smoothness of action is concerned and freedom from derangement, it is no better than either of the other two prevalent types, but where it appears to us to score is in the fact that the doubly gripped central plate, which is the portion of the clutch connected with the gearshaft, can be made so light that gear changing is greatly facilitated, and much less skill and care are required to effect quiet and harmless changes of gear. It seems to provide a form of clutch which is as simple as the cone clutch, and as smooth in action as any but the very finest examples of the comparatively complex and somewhat inaccessible multi-disc clutch. The

practice of lining the single plate clutch surfaces with Ferodo, Raybestos, Thermoid, or one or other of the linings of this sort is growing. The leather-lined cone clutch remains practically unaltered except in two or three interesting developments, which appear to be spreading, that is, running it in oil so that the leather is always kept in perfect condition. The multi-disc clutch has long since entered what one may call the no-trouble class, and the Vauxhall innovation last year of running it dry, and lubricated only by flake graphite, has been quite successful. There is a wide difference between the behaviour of different makes of clutches when gear changing, and many would be improved if they allowed of easier use, so that double clutching was no longer necessary when changing down at fairly high engine speeds and strong torque, such as occurs when climbing a hill at, say, thirty miles an hour, as it should only be necessary to slip the clutch. Many people can change down easily this way who have never succeeded in acquiring facility in the double clutching, and after all considerably slower method. One or two makers still persist in fitting clutches which do not take up the thrust of the spring, but pass it on to the crankshaft, an error in elementary mechanics for which there is really no excuse.

Change Speed Gears.—The increased number of small cars hitherto provided with three speeds which now have four is very gratifying to us, as we have steadily advocated four speeds right through the period when the advocacy seemed almost hopeless, as maker after maker was reverting to three. However, in these matters the right policy must always prevail, and we are naturally pleased to see that in this case it has certainly done so. Gears have been very much improved by giving still greater attention to quietness, as the short stiff box and the short stiff shafts are but expressions of the desire to obtain quiet running on the indirect drives. So also is the attention which is given by the makers to each one of the gear wheels. Indeed, in the best cars the finishing of the gear wheels becomes almost a case of dentistry, as tooth by tooth is individually attended to and ground to an almost absolutely perfect form. Necessarily the indirect drive cannot be as quiet as the direct, but in some of the best instances it is really almost as quiet now, at any rate on the first drop and the second. In fact, on the whole it seems easier to get a quiet second speed than a quiet third. Timken roller bearings are being used in gear boxes for the layshaft as well as in some cases for the primary. The Wolseley is an example of the layshaft adoption. A number of boxes still have the spigot bearing of the plain type, which seems a pity, as it is necessarily always in action when any but the top gear is in use, and it is quite easily avoided with correct design. Comparatively few gear boxes are now seen with the sliding mechanism more or less exposed. In all the best practice it is either contained in the gear box itself or in a chamber connected with it. In many cases great ingenuity has been expended in making it physically impossible for two gears to be engaged simultaneously, and the devices are so complete that even after excessive wear there is still no fear of this distressing occurrence. The chain gear box has not made much headway, though its modern introducers, Maudslay and Dennis, fit it when required, as it has been quite satisfactory, and, of course, is almost noiseless on all speeds and not on the top speed alone. There are a number of instances of gear boxes being practically combined with a forward extension of the differential casing on the back axle, though some of their makers maintain they are not on the back axle at all, but on the end of the propeller-shaft. In the new Sheffield-Simplex there can be no dispute, as the gear box is carried on the propeller-shaft at its forward end. At this end its weight is mainly on the chassis, and therefore it cannot be argued that it materially increases the unsprung weight. So far as we are aware the chief, if not the only, advantage of the removal of the gear box from the frame proper is that it communicates any sound it may make much more indirectly to the occupants of the car.

Final Drives.—Last year we stated that the worm drive continued to increase in popularity, and it did; but the very opposite must be stated this year, as quite a number of firms who for the last year or two have been fitting worm drives have now gone back to the bevel, while others have adopted the middle policy of fitting bevel drives for open cars and worm gears for enclosed bodies. The chief reasons for this reversion to the bevel are three-fold. The first is that many makers are firmly convinced that it wastes more power; the second that they have learned how to make their bevels quiet, though it still remains a laborious process, more or less delicate treatment to each individual tooth, thereby correcting any distortions which may have been set up in hardening, besides any infinitesimal inaccuracies which may have occurred previous to it. The third reason is mainly in regard to the under-hung worm which can carry so small a reserve of lubrication that quite a small leakage in the stuffing box where the wormshaft issues from the differential casing results in under-lubrication unless very regular attention is given to maintaining the proper level. Obviously with the overhead worm a considerably greater reserve of oil can be carried, as the stuffing box is at the top and any loss of its oil-retaining properties is very much less serious than in the case of the under worm. As to the old idea that the over worm could not be properly lubricated, this has been long since exploded, though at the time it was introduced on the Dennis car many people shook their heads and prophesied all sorts of terrible evils, as they seemed entirely to overlook the fact that the worm wheel provided automatic means of bringing lubricant up to the worm before the wheel had made half a revolution.

Universal Joints.—Two most interesting departures in this respect are the Isotta-Fraschini and Panhard. In the former the front universal joint takes the form of a stout leather disc which, while providing flexibility, is absolutely devoid of working parts in the ordinary sense of the word. In the Panhard the device may be roughly described as two flat metal discs in connection with each other but separated by a rubber buffer. This is a new introduction, but the Isotta is over two years old, and appears to have given its makers every satisfaction, while it is being adopted on at least one make of motor 'bus. Quite a lot of ingenuity has been expended on the universal joints between the clutch and the gearshaft, so that any lack of alignment between the gear box and the clutch caused by frame distortion is rendered practically harmless. Till quite recently in the majority of instances too little attention had been given to providing true universality of jointing at this place. To return to the propeller-shaft, the sliding joint is still frequently too small for its work, so that owing to its insufficient area the lubricant is pressed out from between the sliding surfaces and wear is very rapid. Great diversity between the universal joints is shown

in the means of lubrication. Some makers have followed Lanchester practice, which takes advantage of the rotation of the joint to carry the oil to the joint bearings centrifugally. Others are mere grease pots, and it is difficult to see how the working parts can ever be properly lubricated after they have once been made.

Torque and Radius Rods.—Taking the cars in Olympia in the aggregate there is certainly a strong tendency to abolish torque and radius rods altogether —not merely to replace them by a propeller-shaft casing delivering its thrust to the frame by means of a globular joint or through a forked forward end, but by making the front quarter of the springs take the whole of the work of keeping the back axle in position fore and aft and of resisting the natural tendency of the back axle to twist. In other words, they have to perform the function of radius rods and of torque rods. It seems utterly wrong to expect the springs to do this kind of work, and yet they do it, and seem to do it very well. It is hard to cavil at a practice which successfully took home the Sunbeams in their great victory in the Coupe de l'Auto, and yet, as we have said, the principle is not good. It is highly probable that in the long run it will be found that, while the springs may be made successfully to perform this triple function for cars up to a certain power and weight, beyond that the torque and radius rod, or its equivalent, a properly designed propeller-shaft casing, is quite desirable if not absolutely necessary. Nevertheless, there are hundreds of quite large cars without torque and radius rods, and the Daimler may be cited as a conspicuous example.

Bearings.—The ball bearing remains a rarity so far as the engine is concerned, but it or Timken roller bearings are used on practically every other rotating shaft on the car. Timken roller bearings are of the conical type and take thrust as well as load, and there is also a new Hoffmann combination of rollers and balls which strikes us as being good, as the rollers carry the load and the balls take the thrust. The use of Timken roller bearings in the front wheels is spreading, and they will be found also in the back wheels of a good many cars. A good many designers have maintained that ordinary load bearings wear quite satisfactorily for front wheels, but the majority of them seem to have dropped this idea now, and to make some provision for the taking up of the thrust, which is heavier than would be imagined, though after all the behaviour of the front wheel bearing, which has no proper provision for thrust, should surely be sufficient to show how high these pressures are.

Steering.—Apart from the much more general employment of ball thrusts to steering box and steering pivots, the most noticeable improvement is the provision of a complete sector or wheel in the steering box instead of a mere segment. This means that when wear has taken place in one part of the wheel it can be turned round and another portion of it brought into engagement with the worm. Very few cars make provision for adjustment between the worm and wheel, as it is maintained that this is unsatisfactory, because the wear takes place almost entirely on one portion of the sector, and consequently adjustment renders the steering tight elsewhere than in the straight-ahead position. This, however, is only partly true, as a good bit of wear can be compensated if adjustment be provided, and yet the steering wheel still not be unduly stiff when the wheel is put hard over. It seems to us a little stiffness does not matter when well away from the central position. There is a marked tendency to make steering columns adjustable for angle within reasonable limits, so that drivers of varying size can be comfortably accommodated, and seats can be made of varying heights without discomfort to the driver.

Brakes.—There is a growing tendency to concentrate both brakes in the back wheels, but we must say we prefer the pedal brake on the gearshaft and the hand brake on the wheels, (1) because one suddenly acting brake is desirable in sudden emergencies, and no hub brake we have tried gives this, (2) any leakage of lubricant from the back wheel hubs affects both brakes, and therefore results in the locking of one wheel if one hub be leaking, or in the weakening of all the brakes if both be leaking, and (3) the effort required for a sudden stop with the slow acting hub brakes is excessive, and even for moderate braking is tiring, though on long hills it is quite desirable to use the hand and foot applied brakes alternately.

There is one growing tendency in regard to gear-shaft brakes which is mistaken, and that is to drop the external or outside gripping brake of the locomotive type and to replace it by the internal type. This results in a brake which is most inaccessible, and as soon as the adjustment limits are reached the brake can only be attended to by disturbing a number of other under-parts of the car.

Springs.—In the main, springs remain unaltered, though the tendency to follow Lanchester practice by using springs of the cantilever type is growing. Differences from the Lanchester system occur, but the principle is the same. On the other hand, for front wheels the half-elliptic spring is almost universal. Though not actually a spring, the oscillating device of the front wheels of La Buire cars is interesting. It is a revival of a very old principle once applied to bicycles, and consists of an indirect attachment of the stub axle to the main axle, the stub being eccentrically positioned with regard to the axle centre, so that the axle, as it were, hangs upon it. The natural position of the stub and the axle is to remain in the same vertical plane, as the weight holds them thus, but on striking an obstacle the wheel recedes somewhat and is then brought back to its normal position by the weight of the car. It is practically a weight controlled buffer, and should have the effect of reducing the severity of road shocks received by the front wheels. As to supplemental springs, they are more prominent than ever, and deservedly so, as few cars are not improved by fitting them, so long as they are suitable for the weight and the periodicity of their existing springs.

Wheels.—Detachable wheels are now more often fitted than not, but there is considerable diversity as to the means employed for securing and releasing them. Looking at the matter from the private owner's standpoint, there is no getting away from the fact that the detachable wheel is in almost every way an advantage. The detachable interchangeable wheel at once overcomes the delay and trouble of a single tyre derangement, but it makes no provision for the quick and easy battling with the second tyre trouble if the journey should be an unlucky one. It is, therefore, obvious that the simplest combination which will provide this is detachable wheels with detachable flanges, so that, if it becomes necessary to change an air tube on the road, it can be done easily, and, if a spare cover be carried in addition to the one on the spare wheel, it makes even a cover change easy, too.

The wood wheel is steadily losing ground, though

The Modern Chassis: Tendencies of Design.

very far from done with, and the struggle for future supremacy is really between the wire wheel and the hollow steel wheel. Apart from the greater ease of cleaning, the point mainly in favour of the hollow steel wheel is that it is even narrower than the tyre it carries, and, consequently, two spare wheels and tyres complete can be carried in no greater width than a single wire wheel occupies; indeed, a spare steel wheel takes no more space than a spare steel rim.

Bonnets.—Undoubtedly the best tendency of the 1912 Show was the attempt, which has been made successfully by so many exhibitors, to bring the body and the bonnet into harmony; this is achieved by tapering the bonnet and using the dashboard as the final transition. Those designers with a nice sense of proportion have been most successful, and their tapere dbonnets and radiators are a joy to look upon. Others have tapered neither wisely nor well, and have not made the best of their cars in consequence. There is every indication that the chassis of the future will include a taper dashboard designed to suit the bonnet.

The best examples of the taper design commence at the beginning of things, and the radiator has its front corners tapered or rounded, too, so that we do not even start with the short horizontal line of the radiator itself. The first examples of this, we believe, were the Austro-Daimler cars, and there is nothing neater on the market to-day.

The taper bonnet is far from universal, and there are many cars which have a more or less painful discrepancy between the size of the bonnet and that of the dashboard, so that they look by no means complete carriages, whether of the open or closed form. This fault will be corrected during the next twelve months.

Wood or Metal for Coachwork.

IT has been said before now that there are two schools of motor car body builders—one, those who believe in wood, and the other, those who advocate metal. At the same time, there are many builders who cannot be described as enthusiastic adherents of either section, and their work is more or less a combination of the two. Probably it is the combination system which is most widely used to-day. This may be described as a body which has a wooden framing with sheet-metal panels. Not very long since it appeared almost as though the sheet-metal panel would become universally used, but at the present time tendencies are rather the other way, and, speaking broadly, it may be said that there is a reaction towards the all-wooden body, *i.e.*, wood framing and wood panelling.

The Question of Weight.

The popular idea that sheet-metal panelling is lighter than wood is not borne out by facts, and we believe the prejudice which exists against wood is due to the fact that in some of the very cheap work unseasoned material has been used. This, too, has gained a bad name for metal panelling, as it has caused the wood framing to warp and so tear the panelling away. Given good material and workmanship, there appears little to choose between the two systems, but there are certainly no definite proofs that the mainly metallic body is lighter than the all-wood body. There is no doubt that, if aluminium were almost exclusively used, this would not be the case, and, on the score of weight at any rate, the metal-panel body would win, but aluminium panelling is most unsatisfactory, as it is so apt to be attacked by the atmosphere, particularly by salt air. Moreover, it is practically impossible to repair it if it should be damaged in any way, though, when it comes to any bad damage, there is very little to choose between aluminium, steel, or wood, as the only remedy in any case is a new panel. One great advantage of metal is that panels can be beaten to almost any shape desired. Some very graceful contours can be made in wood panelling, but beyond certain limits of curvature metal wins on account of its adaptability.

We dismiss the cast aluminium body used on some foreign cars, also the body stamped in a piece from a steel sheet, because either system is only applicable to cars of the reach-me-down type, as, of course, no variation can be made. The bodies simply come out reproductions of each other without the slightest opportunity for the indulgence of individual taste or the display of originality

The Built-up All-metal Body.

The one type of metal body which does not appear to have been fully developed is what one may call the all-metal built-up body, *i.e.*, a body which has all the framing made of angle-section steel, the ribs all being bolted to the main body framing and the panels riveted, or, we should say, preferably bolted, to the framing. Speaking quite generally, this construction may be likened to that of the modern steel ship. Whether it will be possible to make it lighter or more durable than a really good wood frame we very much doubt, and the indications at the present time are all in favour of the wood frame maintaining its popularity with coachbuilders, not merely because it is the form of construction for which their experience and training best suit them, but because they have not been able to discover any particular advantages in other methods of building. Whether it is going to remain the final system of body building is another matter, and we need not discuss it at the moment, but it certainly is interesting to record that, after the tendency appearing to be so much towards the body becoming more and more metallic, it should now frequently be built entirely of wood except for certain forgings at the door-posts and other such parts, and for bolting together the main framing.

Bodies for Overseas Use.

While discussing body construction, it is not without interest, especially in a book of this kind, to consider the requirements of motorists abroad. There are some parts of the world in which the excessively dry climate, not to mention the white ant, make it desirable that wood should be used as little as possible. So far as we can gather from the reports which reach us from all parts of the world, there is no objection to wood merely because a climate is hot; it depends entirely on the nature of the heat. Humid heat does not appear to have any bad effect on wood, but only excessively dry heat. On the other hand, in a country where the bodies are built by native makers, such as Australia—in parts of which dry heat is prevalent—there appears to be no trouble, this, apparently, being due to the fact that the wood is matured in the climate in which it is to be used.

Details of Modern Body Design.

An Illustrated Criticism written after a Visit to the last Olympia Show.

IT is always difficult to be a critic when one's faith in the idea that one's opinion is representative of the average person's is shaken by untoward circumstances. During the course of my peregrinations around Olympia I paused for a few minutes under the shadow of a bodybuilder's stand in order to rest a pair of elbows that had been wearied by long attempts to "keep moving." The untoward circumstances came along in the persons of five typical visitors. The stand into whose eddy I had been willingly driven by the stream of people exhibited a very prominent, not to say glaring, piece of body design, which personal inclinations led me into thinking was just about as hideous a crime as had ever been committed in the name of automobilism.

By-and-by a smartly-dressed young lady (very superior to the Hebe immortalised by the Show poster) came sailing along, accompanied by an obvious mother. Both, to my surprise, even to my disgust, expressed the liveliest appreciation of the design, and I believe would have been genuine buyers had they possessed the least idea of what such a body would cost. As it was, they recovered very gracefully from the shock of the stand attendant's answer and disappeared into the crowd, giving place to a military-looking old gentleman and a dapper individual whom I at once suspected of beng an agent in disguise. The old gentleman, after a few sharp glances, expressed a forcible opinion extremely uncomplimentary to the design of the body, and in his turn passed out of my range. Another gentleman followed him, and I have a strong belief that the car or its duplicate will eventually pass into his possession. He was a lost man the moment he caught sight of it; he beamed at it, he cocked his head at it, he opened the door and peeped inside with evident satisfaction. Before you could say "knife" the salesman had tackled him, and the victim remained on the stand so long that common decency must, I think, have forced him into ordering at least something.

Meanwhile a young gentleman and a lady came up to make a closer inspection. The young lady was evidently rather struck with the design, but her escort merely sniffed. In the circumstances I thought he did this very eloquently, yet even as he turned to something more interesting another young man, almost identical with the first, came up and volubly admired the thing for the benefit of a couple of friends.

After this I moved on. I had already lost faith in myself, and when, subsequently, anybody happened to ask my opinion of this particular one or any other body in the Show, I contented myself with saying that it was "The Limit," hoping hard for a pointer or two before qualifying the expression into anything more definitely eulogistic or damnatory.

It had been my intention to write something in the nature of a critical article on Olympian bodywork, but this idea has had to be abandoned upon the realisation that to do such a thing fairly is quite impossible. As likely as not the very body which I should pick out as representing the extremity in vileness would turn out to be the one that had sold in unprecedented quantities. The fact is that one can only criticise public opinion, and not the design of the bodywork itself, because in nearly all cases the coachbuilder mounted on his stand those designs which he knew he would have the least difficulty in selling. In all probability many of the examples exhibited were sold before ever they came to the Show at all, and this, taken in conjunction with the fact that the Show year by year becomes a severe commercial proposition rather than an exhibition of capability and cleverness, accounts for the not particularly high standard in design which was reached. New ideas either in design or detail were conspicuously rare, from which I surmise that it is not so much a case of the fount of originality running dry as that one has to progress very slowly in developing bodywork. Indeed, it appears as though a really well-designed, practical, and graceful design would be so conspicuously unlike the standard lines (hateful expression) that are characteristic of stagnant mediocrity that only the most bold spirits would give it more than passing attention. This is a pity, because the time is much too early to arrive at anything like standardisation. Bodies are still woefully wanting in a great many respects, and the room for improvement in nearly every one is obviously very large.

Open cars have, in general, their appearance entirely ruined by the various appurtenances which have to be attached in the way of tool boxes, spare wheels, luggage grids, generators, etc., and for which proper provision is never made, whilst covered bodies are still in the main suffering from the flavour of Cunard smoking rooms, North-Western dining saloons, mid-Victorian boudoirs, and the passenger lifts at Selfridge's. In a good many cases, however, designers have set themselves to alleviate the stuffiness of limousines by substituting rare polished wooden panels for cloth upholstery.

Apart from the facts that such a finish is exceedingly expensive and exceedingly delicate, the move seems to be rather a good one. Certainly enclosed bodies are far more airy and roomy than they were last year, but already there are not wanting signs to show that matters in this respect are being carried to rather an absurd degree. For instance, in one body I was told that there was something like £200 worth of mahogany. Very jolly in its way, indeed, but I cannot help feeling that this sort of thing merely makes carriage-work more expensive without making it a bit better. On the other hand, there is a good deal less of that deplorable tendency towards "fluffiness" which made itself evident a year or two back. The stuffs which are now used for the best upholstery may be more expensive than ever they were, but they are certainly plainer and are of a type that has a much better chance of withstanding hard wear.

As a matter of fact, there were one or two cases of firms who had had enough commonsense and foresight to use a washable leather for internal upholstery. I do not believe that the average man could possibly have, or desire, anything better. If only utility would more frequently and more pronouncedly temper mere luxury how generally good would bodies become.

Progress so far as it concerns the actual shape, arrangement, and design of bodies appears to move very slowly. Thus, for instance, in open bodies reasonable freedom of access to the driver's seat without upsetting the front passenger is quite the exception, whereas it ought unquestionably to be the rule. Then again, designers do not seem to be able to make

up their minds whether it is the owner who drives an open car or a chauffeur. At first glance one would not think that there was any difference to be made, but as a matter of fact the distinction is a very marked one, because in the eyes of coachbuilders it is quite evident that chauffeurs are all of the same size, viz., 5ft. 6in. maximum height, whereas owners quite frequently run to as much as (one judges) 7ft. or 8ft. in height. In consequence open touring bodies either have practically no room in front and acres of space to let behind, or *vice versa*, whilst at the same time the front seats of landaulets and limousines are in general just as cramped and inadequate as they always have been. I cannot imagine any reasonable excuse for this state of things, because it should be sufficiently clear that the comfort, or at all events, the freedom of movement of the driver, whether he be amateur or professional, is of paramount importance.

Chassis, of course, differ very widely in the length and width available for bodywork, and hence it is impossible to attempt to lay down any hard and fast rule as to how much of this length should be assigned to the front seats and how much to the back, but if either part is to be over a certain minimum size it ought to be the front. If one is to judge by the bodies at the Show it is quite clear that closed carriages, especially those of the internal driving type, are becoming more and more common, and this may be ascribed to the fact that this type of body is the only one that is really and truly suitable for all purposes and all weathers. It is still, however, a long way from being practically perfect. The driver and his passenger have generally to get to their places by climbing over or past some sort of folding or sliding front seat, which is almost certainly grossly uncomfortable if it folds into a small space, or else if it gives reasonable accommodation and comfort it makes getting in and out a matter of difficulty.

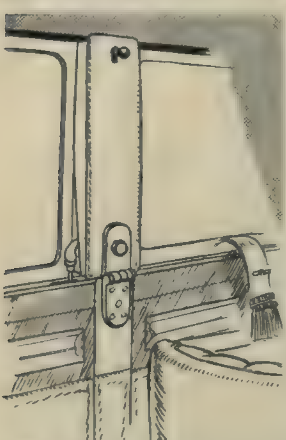


Fig. 1.—The hinging centre post of the Cabriocann body.

This arrangement is, of course, occasioned, and justly so, by the advantageous use of a single door on each side of the body, but it appears, however, in several bodies which have two doors on the near side, and for this I can see no excuse, especially when the chassis is long enough to give all the space required for complete freedom of access to both seats. Folding seats of this type are to be pardoned in my view only in those small saloon bodies which are brought well within the wheelbase of a comparatively small car.

Mulliner, of Brook Street, and Cole and Sons, of Kensington, each showed an example of this type of carriage which seems to me to have a great deal to recommend it. In proportion to their actual size both these bodies appeared to have more accommodation than the usual full-sized all-enclosed limousine.

The ordinary type of outside driving limousine has undergone very little improvement, except that which has followed a general tendency in all bodies to get rid of extraneous ribs and mouldings and to go out for genuine flush-sidedness. Of course, there were a few cases which went to show how horrible otherwise innocent curves can look when they are jumbled together anyhow, and there were also cases where "glassiness" existed to an abominable degree. This latter quality it is easy, however, to judge too harshly, because where a body is designed, perhaps, expressly to catch the eye or to suit the ends of an Eastern Potentate, it is necessary to introduce a Crystal Palace-cum-Brighton Pier touch.

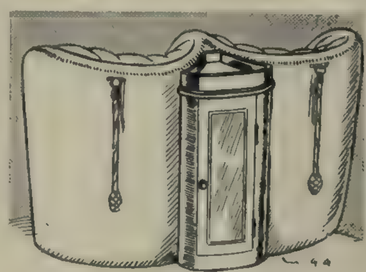


Fig. 2.—The mahogany cabinet shaped to fit between the bucket front seats on a Cann special cabriolet body.

It is good to see that one or two limousine designers have realised that this type of body is *par excellence* the greatest victim of wind resistance. Short of using a "Vee" front, which is almost impossible except in an enclosed driving body, the only way the resistance can be decreased is to round the back of the car off.

The Regent Carriage Co. had a good example of what can be done in this line without sacrificing appearance to any appreciable extent. As a matter of fact, my personal opinion was that in this case the rounded roof and sides and rear panel were so harmoniously combined that the appearance was unusually agreeable. For the same reason I am heartily glad to see that square corners are no longer essentials of landaulets. This class of body has certainly been enormously improved, and there is now little to choose between it and the ordinary limousine beyond the fact that one cannot have a really large rear light and the other can.

Many of the coachbuilding exhibitors, especially Van den Plas, showed how a landaulet can be made with practically no side panel to the head at all; that is to say, the quarter light extends from the door to within a few inches of the back panel. The mechanism involved in the folding heads of both landaulets and cabriolets has certainly been improved. In many cases it is completely hidden out of sight, but most bodies of this type still have far too much overhang, and the head takes up altogether too much room when folded. This difficulty, no doubt, has contributed to the increasing popularity of the well-lighted limousine, in which all the glasses can let down when desired.

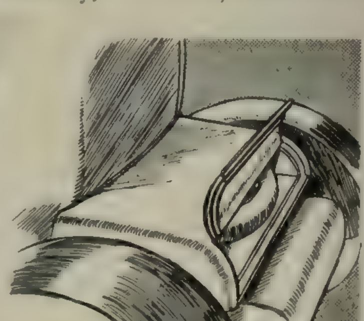


Fig. 3.—The tyre box on a body shown by H. J. Mulliner & Co.

Of devices to prevent or moderate the rattlesomeness of cabriolets there were several, but, generally speaking, they all imposed additional work during the conversion from open to closed. Amongst the cabriolets I was particularly struck with Messrs. Offord's work, because they have succeeded in making bodies of this type which are so light and simple as to be well adapted for use on quite a low-powered chassis.

In this case the folding is accomplished by means of a series of automatic joints which provide so easy a manipulation that the conversion of the body can be done by one man in a few seconds. Of course, the chief disadvantage of the cabriolet is that it necessitates folding pillars and thick doors inside which the side windows are housed. The few inches taken up in this manner certainly have a markedly bad effect on the space inside the body, and this is where the Condick arrangement of the Bristol Carriage Co., in which the side windows slip into a recess behind the driver's seat, is so good.

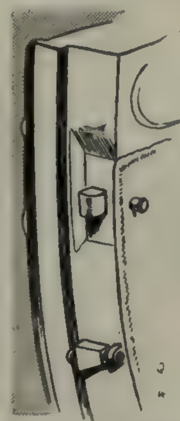


Fig. 4. — The door locking arrangements of a Penman body. The wedge-shaped piece is adjustable so that rattle may be stopped when wear of the door catch occurs.

Last year several cabriolets were shown in which the side windows were made detachable and not sliding; they therefore were incapable of adjustment. So far as I can see this barbarous arrangement has died a natural death, and, I should think, is very unlikely to be resuscitated. Seeing that there are now several substitutes for glass which are almost as transparent and much thinner and more flexible, I imagine it would be quite practical to fix in a light cabriolet a frameless window of this material which could slide into a pocket which would take up practically no room whatever, since it could be curved to suit the section of the door.

In nearly all the closed bodies shown there were examples of window adjustments which would provide complete preventives of rattle. The ordinary strap and peg device as used in railway carriages dates, I believe, from the early eighteenth century, and it is a source of continual wonder to me that something better has only recently been arrived at. Frameless glasses, by the way, seemed, if anything, to be going out.

Fig. 5.—Sketch showing the twin door catches on a Van den Plas body. These are wedge-shaped to prevent rattle.

A rather singular thing which one could not fail to notice in practically all the open touring cars was that no measures have been taken to provide any protection for the occupants of the rear seat. As everyone in the world knows, a front wind screen has little or no effect whatever upon passengers sitting more than two or three feet behind it. There are such things, of course, as the Auster extending back screen, but this sort of thing is for some inexplicable reason ranked as an extra on even the most luxurious and expensive turn-outs. It is true that on several bodies a kind of second dashboard had been arranged behind the driver's seat. This is certainly useful, and, I think, improves the appearance of the car as well as serving the purpose of keeping the draught away from the feet of the rear occupants, but that it can have little or no effect upon protecting them from the wind is obvious.

The appended sketches and following notes relate to some of the particular things that caught my eye in inspecting the bodywork generally. Neither the notes nor the illustrations make any pretence to completeness, and it is unavoidable that a great many excellent features have been left out. They consist, in fact, of a mere haphazard collection of impressions arranged with no regard to merit, but simply in the order in which particulars happened to be jotted down in my notebook.

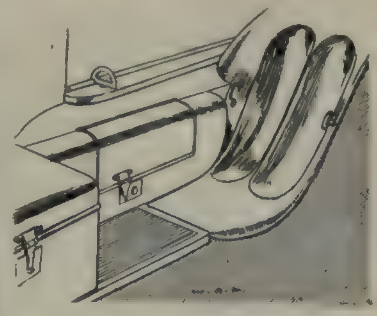


Fig. 6.—The provision for carrying two spare tyres on a Van den Plas body. The off side wing is formed to take the tyres as shown, thus carrying the tyres more forward than usual, and allowing access to the driver's seat from this side. It will be noticed that, in addition to the tool box on the footboard, another tool box is let into the valance.

Fig. 1 shows a very ingenious window pillar employed in the latest pattern Cabriocann type of body. This carriage is practically an internal driving limousine which can be converted into an open car. In other words, there is no permanent division between the front and the rear seats. The arrangement of the head and the joints which control it was very excellent indeed, and the whole thing folded down unusually close and small, leaving only the front pillars which supported the wind screen. The intermediate pillar, on each side of which was a door, was stowed out of the way in a very ingenious manner, which is illustrated in the sketch, which shows it as arranged with the hood up. It does not, however, support the hood, but need only be used in the position shown when it is desired to have one or both of the window glasses up. When the windows are let down the pulling down of a knob at the top of the pillar allows it to swing transversely upon a large hinge, whilst a further pin-hinge is provided so that it can pivot in a

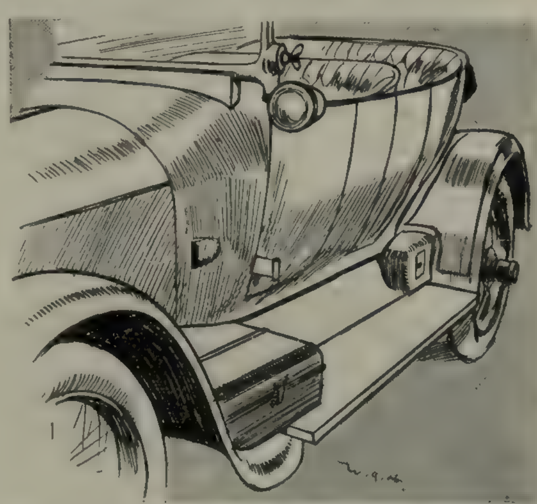


Fig. 7.—A flush-sided Van den Plas body with a tool box formed to the contour of the adjacent portion of the front wing. The front anchorage of the back springs is enclosed in a special casing.

plane at right angles with the former. This arrangement allows it to drop down flat against the side of the body between the two doors without fouling the front seats, which are immovable. In this position it takes up no useful room, and a catch prevents it rattling.

Cann, Ltd., also showed a very charming little Medicann coupé, in which the folding head was very well contrived to drop down into so small a space, and with so little overhang, that the occupants of the

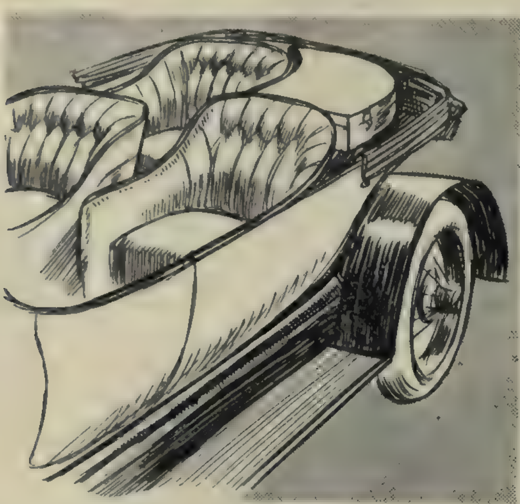


Fig. 8.—A peculiar three-seated body on a Grégoire. Behind the near side seat is a receptacle for luggage.

dickey seat behind would be quite well off for room. A great many dickeys stuck behind coupé fronts exhibited the certain fact that the passengers would have the folding head coming pretty well under their chins. Another Cann point which I noticed was a rather neat little cupboard (fig. 2) mounted behind the two tub seats of the special cabriolet body which I have just mentioned. These pieces of cabinet work do not, as a rule, interest me much, but in this case I thought the arrangement was very neatly and sensibly carried out. One thing, however, rather surprised me, and that was that expensive inlaid mahogany should be used for these "dinky" little affairs, for I should have thought that on touring cars, where usage is apt to be hard, vulcanite or aluminium or some hard-wearing composition would be much more serviceable than polished wood, which is easily ruined in appearance by a single scrape of the boot heel. I see no reason, too, why such substances as "xylonite" or "galalith" should not be used in place of the polished wood which this year has been such a notable feature of internal finish in the majority of bodies. Such material is exceedingly easily workable, is absolutely weather-proof, can be made in almost any colour, and, being homogeneous, should be capable of standing almost any amount of wear without showing seriously ill effects.

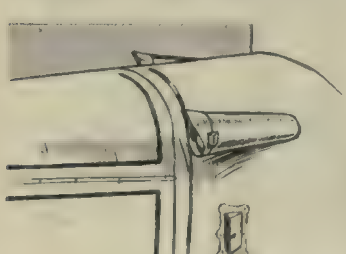


Fig. 9.—The electric lamps and scuttle ventilator on a Grégoire body.

Fig. 3 is a sketch of the tail-piece of quite an admirable little enclosed driving body, which was mounted on a Lancia chassis by Messrs. H. J. Mulliner and Co. The beauty of this design was that the whole of the body was brought well within the wheelbase, yet there was no lack of roominess. In the tail-piece, as shown in the sketch, a sufficiently deep cupboard was installed to enable the spare wheel and tyre to be carried out of sight, and also out of the way of dust and wet. Now that it has been shown that this can be done, as in this case, thoroughly effectively, it is difficult to see what excuse there can be in any covered body to have the spare wheel still in its grotesque position on the running board. It is quite possible that the idea of this position of the wheel being something that cannot be easily avoided, has more than anything else led to the neglect of providing means whereby the driver can get into the car on his own side. Now, however, we have some reason to hope for better things in the future.

I have already referred to means taken to reduce the likelihood of cabriolets and landaulets rattling. Most of these were rather clumsy, but there were two very good things exhibited for performing the very same office with regard to the doors. One, viz., the method adopted by Messrs. A. C. Penman, is illustrated in fig. 4, which shows the edge of the door. This is fitted with the ordinary type of snap lock, but below it there is a dovetail or wedge piece which fits into a suitably shaped cavity in the door jamb. In order to provide against the effects of wear, which, after a short time, are quite capable of destroying the tightness of a fixed wedge piece, Messrs. Penman's dovetail is made adjustable, and a quarter-turn of a screwdriver on the small transverse thread is calculated to be quite sufficient to keep the door as tight as wax should use develop slackness in it.

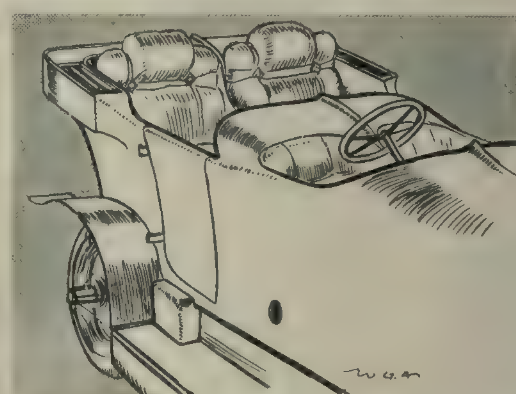
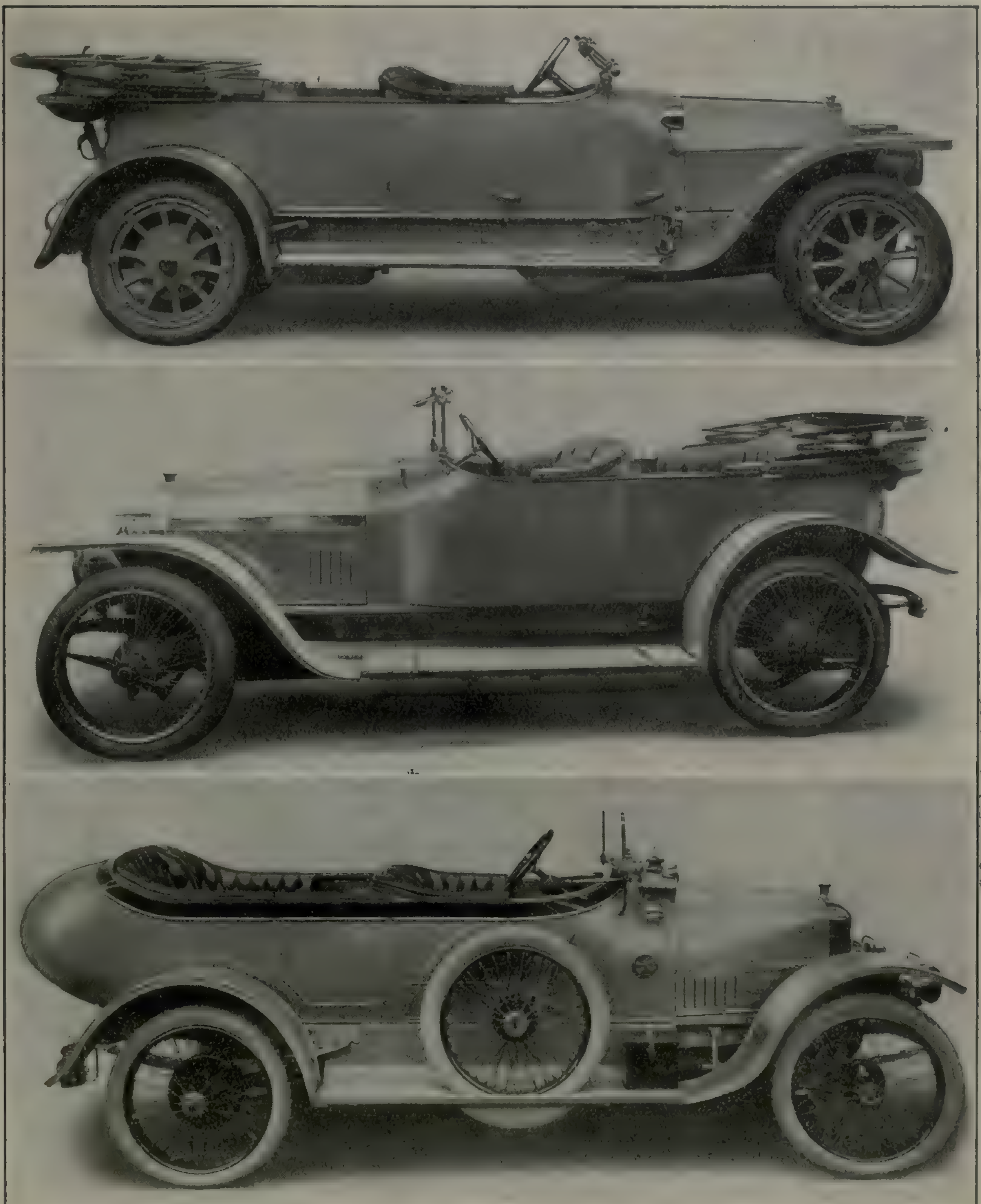


Fig. 10.—Sketch of the Kellner body on an N.A.G. chassis. The peculiar formation of the upholstery of the back seats will be noticed, also the case enclosing the hood. The ring let into the panel below the driver's seat is the horn orifice.

The ingenious Van den Plas went about the matter in quite a different way, and succeeded in striking what I believe to be something near a perfect solution of the door problem. This is illustrated in fig. 5. Instead of working a lock of the usual type, the door handles, both outside and inside, operated two wedges, one at the top of the door and one at the bottom. These wedges were adapted to fit against two claws fixed in the door jamb. Consequently when the door was shut and the handle turned the effect was the same as if the whole door was being pressed home against its rubber buffers with a vice, irrespective of any wear that might develop on the wedges.

Van den Plas had several other notable points besides. Fig. 6 shows the arrangement in the neighbourhood of the off-side front mudguard in the 26 h.p. Métallurgique "Berline de Voyage." The two spare wheels are carried side by side sufficiently in front of the front door to allow the driver to get in on his

The Modern Flush-sided Open Touring Body.



These three examples of typical British coachwork show the tendency of the bonnet to become part of the body by the merging of the bonnet, scuttle, and dashboard into the lines of the body itself, the idea being to obtain a note of harmony from the radiator to the back panel. The three cars, reading from top to bottom, are: 24-40 h.p. Lancia, 40-75 h.p. Lorraine Dietrich, 15.9 h.p. Grand Prix type Calthorpe. The coachwork of the first two is by Maythorn and that of the third by the builders of the chassis—the Calthorpe Co.

Modern Body Design.

side. For this purpose two wells are sunk into the front mudguard. Further, it will be noticed that, in addition to the metal tool box carried on the running board, a second one is let into the valance underneath the rear end of the bonnet. This Van den Plas "Berline" was an extraordinary example of clever design; with its first-class and second-class wash-hand basins, portable dinner and tea services, dry and wet canteens, roll top writing desk, and, indeed, everything that opens and shuts, it was a marvellously complete touring vehicle, and the possession of it would, I imagine, almost allow its owner to dispense with any more permanent abode. The most pleasing point, however, was that all these wonderful contrivances, including, by the way, tilting armchairs in the back portion, had been got into a body which was the epitome of graceful lines and desirable form.

Fig. 11.—The collapsable seats of the Kellner body. The adjustable foot roll is also seen.

The other Van den Plas bodies were also very fine, the 20-40 h.p. Métallurgique torpedo de luxe having really beautiful lines. I have made a sketch (fig. 7) of one side of this carriage in order to show the arrangement of the tool box, which is fixed on the extreme forefront of the running board, and is adapted to fit the curvature of the front wing. It will also be noticed in the sketch that a box-shaped housing covers in the front shackle of the rear spring. The electric side lamps on this car were attached by means of a special fitting to the wind-screen brackets.

Quite the majority of body designers have gone in for the Alpine or inverted scuttle dashboard, and, as a rule, there is only one objection to this, viz., that it rather restricts foot room. Van den Plas, however, I noticed, used a shape of panel in which the concavity of the curve only applied to the upper part, whilst at the base, as shown in the sketch, the dashboard was actually slightly swelled out (fig. 7).

Close by the Van den Plas exhibit, and an extraordinary contrast to it, since the bodies of the latter designer were the embodiment of artistry and good taste, stood an immense yellow car in the form of a triple Berline on a Grégoire. As considerable attention has been given to this body, and details have already appeared in *The Autocar*, it is unnecessary for me to discuss further a design of which I certainly do not approve. I cannot resist, however, mentioning two points, viz., the inadvisability of mounting an elaborate and, I have no doubt, heavy body on a 16-24 h.p. chassis, and the peculiar arrangement of the cabinet work inside. At the back division behind the driver's seat was quite a large sized and very elegantly made cabinet, but instead of putting it to any useful purpose and providing it with compartments large enough to hold a respectably sized parcel, it was fitted with no less than twelve very small drawers, each only about big enough to hold a couple of pairs of gloves.

Fig. 12.—One of the side lights on the wings of the Kellner bodied N.A.G. car.

Although it was not so striking, the open body mounted on another Grégoire chassis was much more interesting. Fig. 8 gives a sketch of the back part of this car, which has a good many points to recommend it. There are, it will be perceived, only three seats, all of the armchair kind, that of the driver being slidable. The place of the fourth seat is taken up by a large curved box big enough to hold any amount of luggage. A good point in this car, too, was the arrangement of the hood, the sticks of which were unusually short, and the whole thing lying notably flat when folded down. Altogether this body struck me as being very practicable indeed. Special side lamps were sunk into the tapered dashboard, as shown in fig. 9.

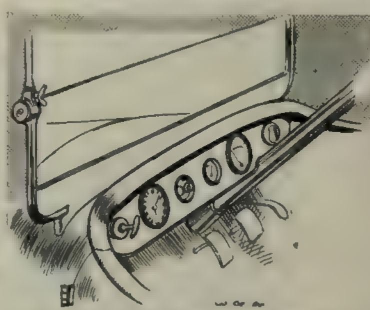


Fig. 13.—The instrument board on a body by Captain Masui.

The renowned D'Ieteren Frères had an exceedingly elegant torpedo phaeton on a 25 h.p. Delaunay-Belleville, and in this the side lamps were neatly sunk in the dashboard, but they certainly could not be said to indicate the extreme width of the car. The body was exceedingly beautiful, and no one who has done any touring could fail to admire the very convenient hood, which, when up, offered no bar to ingress to either the front or rear seats.

Whilst touching upon the subject of lamps, it may be mentioned that perhaps the best thing of its kind in the Show was the arrangement of the side lamps on the Napier saloon body built by the Cunard Motor and Carriage Co. In this case two small egg-shaped electric lamps were mounted on the front of the mudguards, and came within only an inch or two of showing the real width of the car.

Without being glaringly *outré*, probably the most interesting touring open body in the Show was the Kellner torpedo on the N.A.G. stand. Whilst personally I do not agree with every part of the design, I must admit that this car had an extraordinary number of good "points." Indeed, it gave evidence of an unusual amount of originality and at the same time of practical care having been exercised. Fig. 10 illustrates the rear portion of this body. The most prominent feature is the special form of casing which is made for the hood, the lines of this being very agreeably led off into the rear panel. When out of use the hood is quite completely boxed in by means of three easily detachable lid sections. The general appearance is very pleasing indeed, but it would be hard to imagine anything that was not superior in this respect to the ordinary Cape cart hood when folded down.

Fig. 14.—The step mat and running board rails on a Masui body fitted to an 18-26 h.p. Sava.

The next point is the seats; all of these were of the saddlebag type, and comfortable to a fault. I am afraid, however, that they would require a considerable amount of cleaning up after a dusty run. Whether they are to be regarded as an improvement upon folded, buttoned, or plain upholstery is a matter of individual opinion. Personally, I thought they looked rather out of place. One excellent point they had, however, and that is, that the seat squab was hinged to the back, so that a tilting effect could be obtained by simply pulling the squab forward and fixing it there without any mechanical device being applied to the box on which the seats rested. The back of the front seats was very nicely fitted out with useful little cupboards covered over with a second scuttle. Along the middle of this and also along the centre of the bonnet and the front scuttle runs a sharp little ridge or kerb, which gave quite a distinctive aspect to the car. The small ring let into the panel on the driver's side (see fig. 10) is the gauze-covered horn orifice, and represents so much labour saved in cleaning.

Fig. 15. — Sketch showing one of the small glazed panels on the bottom of the wind screen on a F.I.A.T. landaulet.

Fig. 11 shows the neat arrangement of the folding seats in the back portion. Both were covered with leather flaps, but one of these is not shown in the drawing for the sake of clearness. These seats had comfortable folding backs, and could be brought into use in a moment. At the same time, when out of use they do not detract from the roominess of the interior. The soft-padded roll for the occupants of the rear seats to rest their feet against is also to be noticed. A good idea, this, as the straps by which the roll is fixed enable the position of it to be adjusted to suit individual requirements, whilst unlike a brass footrail these rolls can be pushed back out of the way when not required.

Fig. 12 illustrates the very taking manner in which the side lamps were let into the front mudguards. Here again, as in the case of the Napier, one sees how it is possible to have handsome appearance and a good illuminating effect combined with a respect for the law.

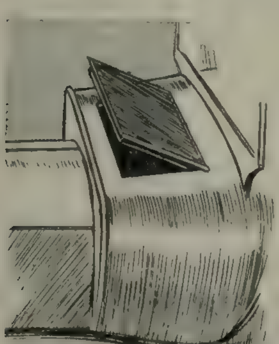


Fig. 16.—The scuttle ventilator on a body by Mulliner, of Brook Street.

Captain Masui had, of course, several interesting body designs, of which one of the most striking was a D-fronted limousine, the lower panel and the rear part of which were finished in a new and rather agreeable style of imitation cane work. As a matter of fact, the imitation was so cleverly carried out that I am convinced that a number of people who examined this body went off with the impression that it was real, and appreciated the value of the car in consequence. The same maker had also an exceedingly well-designed, graceful, and roomy internal driving body on the Sheffield-Simplex stand. In this the driver's seat, an armchair, was arranged to slide forwards and backwards and also tilt, both actions being very easily and swiftly controlled. The internal finish of this carriage was very luxurious and in excellent taste, but surely the limit is reached when capital is made out of the fact that the tops of the doors and side panels are decorated with hand-painted and embossed leather all complete with the artist's signature. Surely from this to a comprehensive mural decoration of frescoes, statuettes, and post-impressionist landscapes is not a far cry, and I should say there would be a big future for hand-painted squabs, embellished, of course, with the signatures of eminent Academicians. Joking apart, however, there is no doubt that Masui bodies are amongst the very finest that are made, and in no way does this designer show the value of his practical knowledge of requirements better than in the arrangement of his dashboards. They are not mere walls on which to hang an assortment of ugly speedometers, clocks, and gauges, but they are real instrument boards which do all that is required of them in the neatest possible manner.

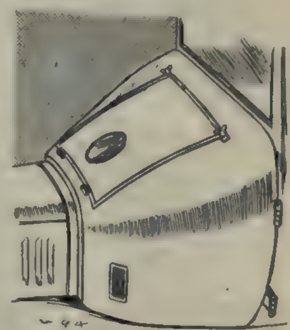


Fig. 17.—The scuttle ventilator and light on a Morgan body.

Fig. 13 shows the dashboard of the round-fronted limousine to which I have already referred. Here one has everything ready to hand, the fittings being a petrol pressure pump, a clock, an oil circulation indicator, a pressure gauge, a speedometer, and a switch. These, it is to be noted, are well under the eye, and require no artificial illumination. Behind and underneath this board are silk nets very convenient for the carriage of parcels. A similar arrangement was used in the Sheffield-Simplex saloon referred to above.

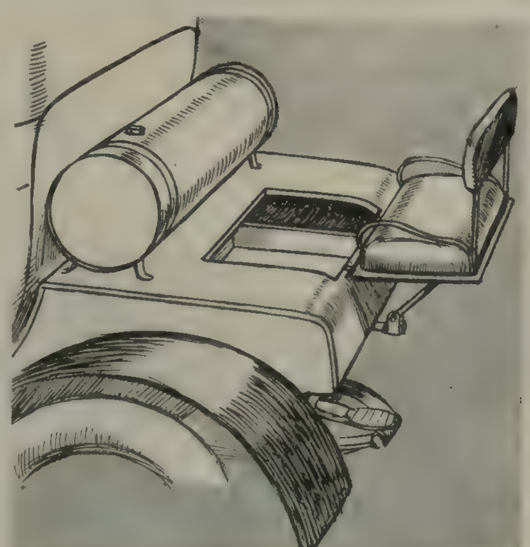


Fig. 18.—Folding dickey seat and tool locker on a Morgan coupé.

There were also two other interesting points on the cane-finished limousine.

In fig. 14 is shown the peculiar arrangement of the running boards. Instead of being wooden affairs topped with rubber sheeting these running boards were of comparatively thin metal and formed extensions of

the front and rear wings, being, as shown in the sketch, provided with a suitable curvature. Each of these running boards, if one may call them so, carried two stout rails, and on these rails were clipped a couple of neat mats forming steps beneath both the front and rear doors. You accordingly wipe your feet

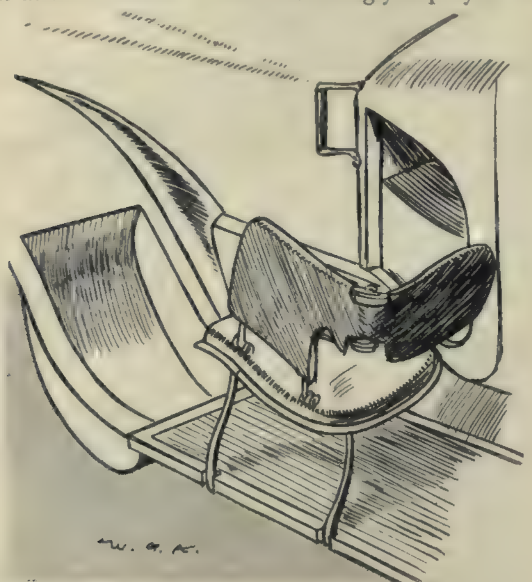


Fig. 19.—The mechanic's folding seat on a body by Mulliner, of Long Acre. This small seat can be folded up and enclosed within the scuttle dash, and the mudguard is slotted to give plenty of leg room.

as you enter the car. Personally I have not yet made up my mind as to whether I like this arrangement or not. It is certainly neat, probably lighter than the ordinary board, and, I should think, easier to maintain in the way of appearance. Then again a tool box provided with suitable clips can be planted on these rails or detached when required in a moment, but, on the other hand, one cannot deny that the rails give an aspect of complication, and rather suggest that if you *did* happen to catch your toe in one of them (and I should think this could quite easily be done), the gracefulness of your exit from the car would not be enhanced. At the same time I cannot see in the least why the rails themselves should be necessary, as both the step mats and the detachable tool boxes could be fitted with an attachment which would lie flush and so offer no obstacle whatever. In order to save the necessity of having a well for the spare wheel this was carried at the side of the car as usual, and was simply attached to a dummy hub supported by a long bracket bolted direct to the side member of the frame, and thus providing a very rigid and neat form of support.

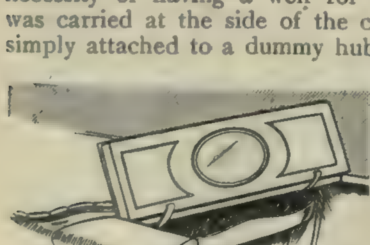


Fig. 20.—The hinged rear scuttle on a La Buire body. The oval panel is a mirror.

Several designers seem to have had some little trouble in arriving at a suitable manner for attaching a wind screen to an Alpine or concave dashboard. Some fix it on the rear edge scuttle, and others a little way forward of this, leaving the last few inches of scuttle behind the screen, and it is this practice that offers the difficulty, the screens shown in figs. 7 and 13 being cases in point. To my mind this forward position of the screen is desirable, because when it rains and the water is blown over the edges of the screen and runs down inside, it will be trapped by the turned-up edge of the scuttle, and prevented from dropping on to the clothes of the driver and front passenger. This, of course, does not always apply to single screens, but it is always exceedingly

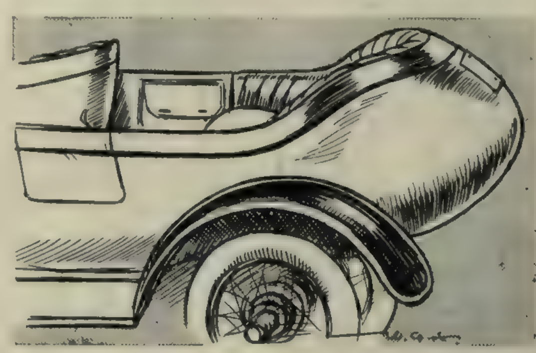


Fig. 21.—The bulbous back of the 15.9 h.p. Calthorpe.

difficult to make double ones proof against driving rain, which easily finds its way between the joint of the two panels.

It is rather unfortunate that these bottom corners of the screen are so important, because if they are left standing rather away from the scuttle they admit more draught than one wants. At the same time how to fill them in neatly is rather a problem. Fig. 15 shows how this matter was attended to in a threequarter landaulet on the F.I.A.T. stand. Quite a number of makers use a mahogany filling piece of somewhat similar shape, but this is inclined to give rather a heavy and "woody" appearance, which the neat little windows used in the F.I.A.T. very well get rid of. This reminds me of the fact which was very observable in nearly all the bodies—that screen irons are generally much neater than they have previously been, but in some cases they were so awkward as almost to spoil the appearance of an otherwise graceful body. There is no reason, as far as I can see, why these irons should not be entirely hidden.

With the coming of what practically amounts to a standardisation of the scuttle dash the disadvantages of the design have happily not been lost sight of, and consequently ventilators in the dashboard are now very generally found. Flaps, too, are not uncommon, but I cannot help thinking that, however well they work and however desirable, they are far from beautiful.

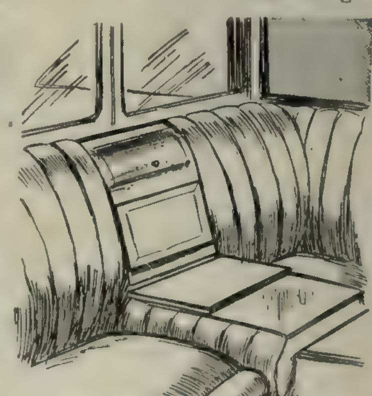
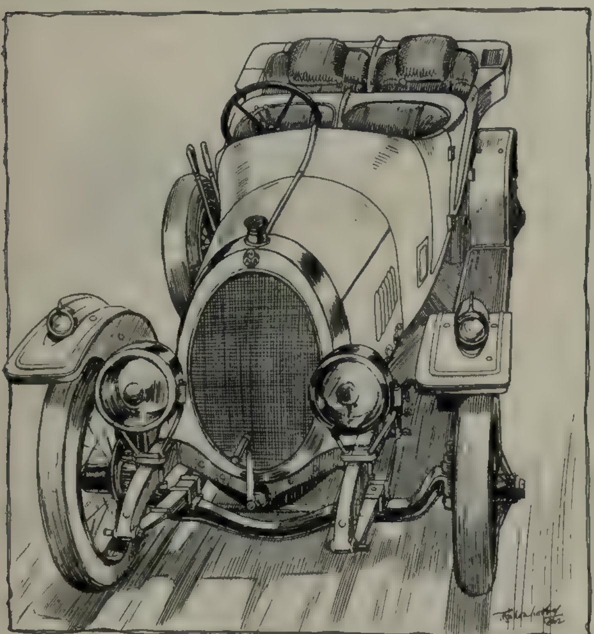


Fig. 22.—The tool cabinet between the two front seats on a Lanchester body.

Fig. 16 shows the trapdoor let into the scuttle of the H. J. Mulliner body I have already described. This trapdoor is installed, I understand, principally to give ventilation, but also to illuminate the dashboard and pedals when required. One thing strikes

one immediately, and that is that when it rains the driver must choose between getting wet or stuffiness. To arrange the flap the other way round would keep out the rain, but its ventilating effect would certainly not be so good.

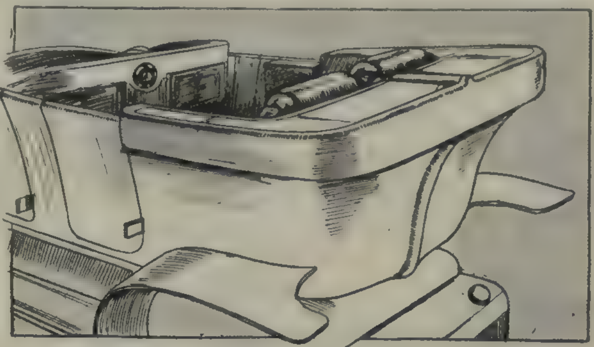
A scuttle flap, hinged in the manner suggested and of a very large size, was also used on an Adler car fitted with a Morgan coupé, as shown in fig. 17. Here the scuttle was so deep and so sharply tapered that some illumination of the dashboard is certainly necessary, and to this end a circular glass light was let into the flap. In the Adler case it will be noted that small permanent ventilators are also fitted, and one therefore cannot help feeling that if these are adequate to their purpose a large glass panel fixed in the scuttle would give an altogether more handsome arrangement. On the same coupé body the dickey seat was arranged in rather an unusual way, and hung out on the tail-piece of the car, being supported by a swivelling bracket arm. The whole thing folds up very neatly, and has the advantage that it leaves plenty of space for tool lockers as shown in sketch fig. 18.



Front view of the Kellner body on an N.A.G. chassis referred to in the accompanying article.

Whilst on the subject of occasional seats one must, of course, refer to the very neatly arranged mechanisms of the seat on an internal driving limousine by Mulliner, of Long Acre, fig. 19. The only disadvantage of this type of body is, of course, that you cannot very easily carry a man, but Mulliners get over this difficulty by using a folding seat which drops back flush into the near side of the scuttle dashboard, and when in use is supported by two folding legs hinged underneath the running board. I tried this seat, and with its folding back and side piece it was certainly quite comfortable. A sunk footboard, it will be noticed, is let into the mudguard. It is worthy of note that the running boards are of sufficient width to carry a fair-sized trunk strapped on to them, and to ensure that the external passenger is not scraped off if matters are cut pretty fine with another car.

As will have been gathered from what has already been said, the use of a rear scuttle is become considerably more frequent, and when it is a permanent fixture it rather suggests a good place for the petrol tank. In the case of the open touring torpedo on a La Buire the scuttle consists of a flap which folds down on to two curved extensions on the top of the side doors, and to this it is locked when it has dropped down. When the door is open the flap, of course, has



Another view of the Kellner-bodied N.A.G. showing the casing completely enclosing the hood.

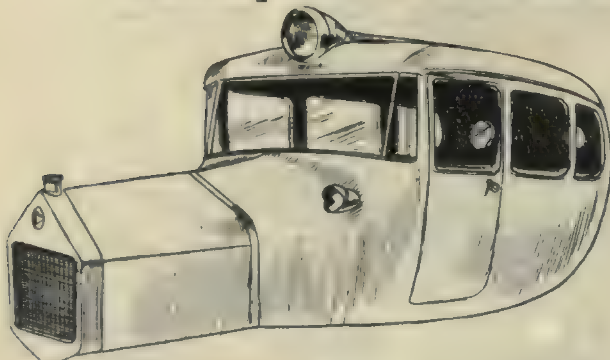
to be lifted, but this disadvantage would, I am sure, be more than made up for from the ladies' point of view, by the fact that the flap was furnished with a sensibly large-sized looking glass (fig. 20). Underneath it a useful tray was fitted.

There are not so many signs of bulbous backs being used, in an attempt to get a stream-line shape and incidentally extra luggage accommodation on four-seated touring cars, as I had expected, but probably the bodies at the Show are not a good criterion in this respect, seeing that so many of them were closed carriages pure and simple. The "Prince Henry" Vauxhall was an exception, and also the 15.9 h.p. semi-racing Calthorpe, of the latter of which I have made a sketch (fig. 21). For the large amount of space that is apparently available the door at the top of the bulb strikes me as being decidedly inadequate, because in my opinion room ought to be made for a spare wheel at the very least. Fig. 22 illustrates the very neat tool locker arranged between the front seats of a 38 h.p. six-cylinder Lanchester, on which special sliding tool boxes on the running boards are also used.

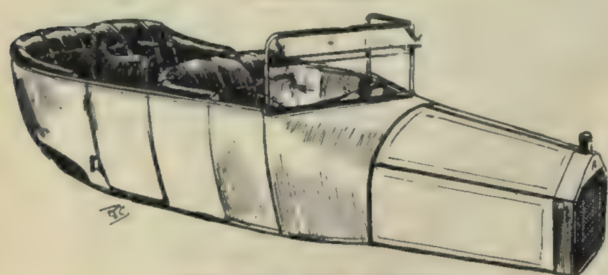
W. G. ASTON.

Haywood (Singer car), winner of the 1912 Standard Chassis Race at Brooklands, making a momentarily halt for replenishing purposes Although there were only eight starters, the race attracted a great deal of interest by reason of the fact that only Standard Chassis as sold to the public could be entered, the only departures from standard practice allowed by the regulations being in the matter of petrol tank, rake of steering, and carburetter adjustment.

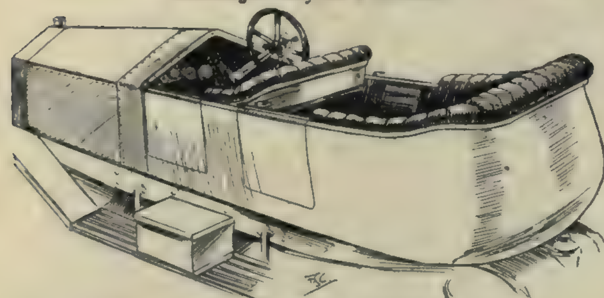
Examples of Modern French Coachwork.



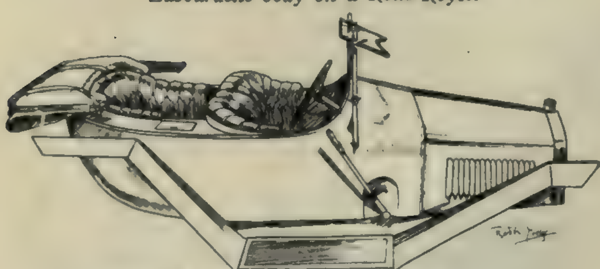
Sizaire-Naudin.



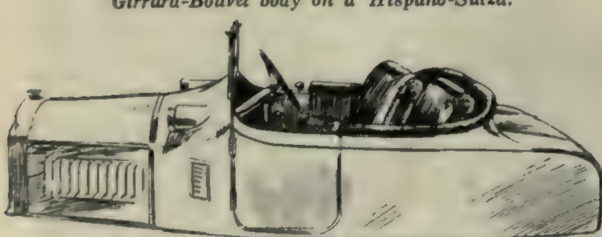
Glissberger body on a Martini.



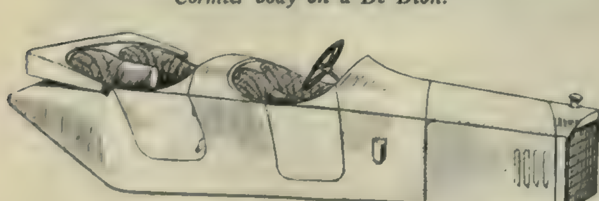
Labourdette body on a Rolls-Royce.



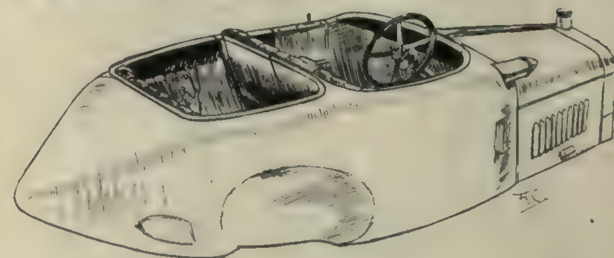
Girrard-Bouvet body on a Hispano-Suiza.



Cormier body on a De Dion.

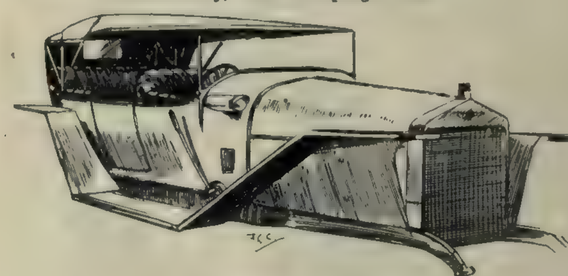


The 90 h.p. Mercédès.



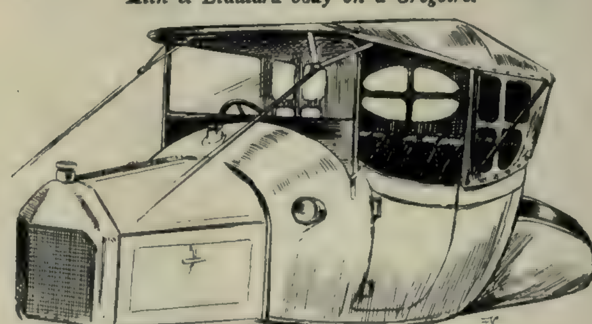
Hispano-Suiza.

Turcat-Méry, with Lamplugh seats.



Hispano-Suiza.

Alin et Liautard body on a Grégoire.



D.F.P.

G. Diatto-Garauni body on an Aquila.

The AUTOCARS of 1913.

An alphabetically arranged Table of Cars on the British Market, with the chassis and complete car prices, principal mechanical features, and leading dimensions.

INPORTANT NOTE.—The prices given are those ruling in Great Britain. To these must be added the cost of freight, import duties where they exist, and agents' charges. A list of the freight charges and import duties in the various countries will be found on page 38.

The columns are so nearly self-explanatory that with the exception of the following nothing requires definition:

PRICE:
Car complete. The chassis is fitted with an open touring body, tyres, tools and spares, but not with lamps, hood, screen, etc., unless specified in a foot note. *Chassis only* means with tyres, tools and spares, unless specified otherwise.

WEIGHT OF CHASSIS:
This includes tyres and all tanks, the latter empty. It does not include tools or spares.

IGNITION:
Mag. = *Magneto* only. *Acc.* = *Accumulator* only. *M. Acc.* = *Magneto and Accumulator* (separate systems). *Dual* = *Magneto and Accumulator combined.*

BODY SPACE:
The body space is the area of frame provided upon which to erect the body, *i.e.*, the length of frame back from the dash and the width of frame.

A

H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
		mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
16-20 Aberdonia (4) ... England	19.8	89×127	3160	£400	—	—	18 0	3	Bevel	Dual	10 0	4 8	6 0	13 4	7	8 0	×2 6	7 0	820×120	820×120
*16-20 Adams (4) ..... England	19.2	88×120	2918	£365	£410	5	18 0	4	Bevel	Mag.	10 0	4 7½	5 9	13 10	8	8 1	×2 10	7 2	815×105	815×105
10 Adler (4) .... Germany	10.5	65×98	1300	—	£280	2 or 3	11 3	4	Bevel	M. Acc.	8 2	4 1	5 5	12 0	6½	6 10½	×2 11	6 0	750×85	750×85
12 Adler (4) .... ,,	13.9	75×103	1820	—	£330	4	14 2	4	Bevel	M. Acc.	8 10	4 3	5 5	12 6	7	7 2½	×2 11½	6 6	810×90	810×90
14-18 Adler (4) .... ,,	13.9	75×120	2116	—	£370	4	16 0	4	Bevel	M. Acc.	9 2½	4 3	5 6	12 6	7	7 9	×2 11½	6 10	815×105	815×105
15-25 Adler (4) .... ,,	15.8	80×130	2610	—	£500	5	20 0	4	Bevel	M. Acc.	9 4½	4 7	5 9	15 3½	7¼	8 8½	×2 11½	7 0	820×120	820×120
25-35 Adler (4) .... ,,	21.0	92×148	3927	—	£625	5	22 0	4	Bevel	M. Acc.	9 10½	4 7	5 10	15 4	7½	8 8½	×2 11½	7 0	880×120	889×120
35-45 Adler (4) .... ,,	32.2	114×160	6528	—	£795	5	24 2	4	Bevel	M. Acc.	10 6	4 7	5 10	15 4	7½	8 8½	×2 11½	8 0	895×135	895×135
55-65 Adler (4) .... ,,	38.8	125×160	7853	—	£955	5	26 3	4	Bevel	M. Acc.	10 6	4 7	5 10	15 4	7½	8 8½	×2 11½	8 0	935×135	935×135
15 Albion (4) .... Scotland	15.5	79×127	2492	£360	£444	4	18 0	3	Worm	Mag.	9 0	4 9	5 5½	12 7	10¼	8 2½	×3 0	7 2¼	815×105	815×105
*10-12 Alldays (2) ..... England	11.2	95×115	1630	£210	£252	2	13 0	4	Bevel	Mag.	8 6	4 3	5 1	11 6	9	7 0	×2 6	5 10	760×90	760×90
*12-14 Alldays (4) ..... ,,	14.3	76×120	2174	£240	£325	5	14 1	4	Bevel	Mag.	9 0	4 3	5 1	12 6	9	7 4	×2 6	6 4	760×90	760×90
*16-20 Alldays (4) ..... ,,	18.4	86×130	3016	£290	—	—	15 3	4	Bevel	Mag.	9 0	4 6	5 4	12 8	9½	7 4	×2 6	6 6	815×105	815×105
*16-20 Alldays (4) ..... ,,	18.4	86×130	3016	£300	—	—	15 3	4	Bevel	Mag.	9 9	4 6	5 4	13 6	9½	8 0	×2 6	7 0	815×105	815×105
*24-30 Alldays (4) ..... ,,	24.8	100×130	4082	£340	£430	7	20 1	4	Bevel	Mag.	9 6	4 6	5 6	13 9	9½	8 4	×2 8	7 0	820×120	820×120
*24-30 Alldays (4) ..... ,,	24.8	100×130	4082	£350	—	—	20 1	4	Bevel	Mag.	10 6	4 6	5 6	14 9	9½	9 4	×2 8	8 0	820×120	820×120
*30-35 Alldays (6) ..... ,,	33.6	95×115	4890	£450	£570	7	22 2	4	Bevel	Mag.	11 6	4 9	5 9	14 9	10	9 4	×2 11	—	880×120	880×120
*12-18 Argyll (4) ...... Scotland	12.8	72×120	1953	£285	£375	4	14 0	4	Worm	Mag.	9 0	4 3	5 5	12 4	7	7 7	×2 9½	6 10	760×100	760×100
*15-30 Argyll (4) ...... ,,	15.8	80×130	2610	£450	£575	5	18 2	4	Worm	Mag.	9 10	4 5	5 8	13 6	8	8 3½	×2 8½	7 3½	815×105	815×105
*15-30 Argyll (4) .... ,,	15.8	80×130	2610	£450	£575	5	18 2	4	Worm	Mag.	10 7	4 5	5 8	14 1	8	9 0½	×2 8½	8 0½	815×105	815×105
*25-50 Argyll (4) .... ,,	24.8	100×130	4082	£615	£750	5 or 7	22 0	4	Worm	Dual	10 6	4 8½	6 2	14 3	8½	8 5	×3 0	7 5	880×120	880×120
*25-50 Argyll (4) .... ,,	24.8	100×130	4082	£615	£750	5 or 7	22 0	4	Worm	Dual	11 3	4 8½	6 2	15 0	8½	9 2	×3 0	8 2	880×120	880×120

*16-20 h.p. Adams has compressed air self-starter. *Alldays chassis prices do not include tyres. *Argyll accessories fitted to complete cars include one man hood, wind-screen, three Lucas lamps, Lucas horn, number plates, and one extra Dunlop detachable wire wheel; chassis prices include fifth Dunlop detachable wire wheel and tyre.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
A (cont.)	*12 Ariel (4) .... England	14.3	76×120	2174	£255	£300	2 to 5	11 2	3	Bevel	Mag.	8 3	4 0	4 10	11 8	7	6 11	2 6	6 0	760×90	760×90
	*12 Ariel (4) .... ,,	14.3	76×120	2174	£280	£325	2 to 5	12 0	3	Bevel	Mag.	8 8	4 4	5 4	12 6	7	8 2	2 8	6 5	810×90	810×90
	*15 Ariel (4) .... ,,	15.8	80×130	2610	£325	£370	2 to 5	13 0	3	Bevel	Mag.	9 6	4 4	5 4	13 4	7	7 7	2 9	6 7	815×105	815×105
	*20 Ariel (4) .... ,,	20.1	90×130	3307	£395	£440	2 to 7	21 0	4	Bevel	Dual	9 8	4 6	5 6	13 9	7	8 2	3 0	7 0	820×120	820×120
	*25 Ariel (4) .... ,,	24.8	100×130	4082	£450	£495	2 to 7	21 2	4	Bevel	Dual	9 8	4 6	5 6	13 9	8	8 2	3 0	7 0	880×120	880×120
	*15-20 Armstrong-Whit. (4) Eng.	15.9	80×135	2710	£375	£475	5	16 0	4	Worm	Dual	9 8	4 6	5 9	13 6	9	8 2½	2 10½	7 1½	815×105	815×105
	17-25 Armstrong-Whit. (4) ,,	17.9	85×135	3051	£435	—	—	17 0	4	Worm	Dual	9 8	4 6	5 9	13 6	9¼	8 2½	2 10½	7 1½	820×120	820×120
	25-30 Armstrong-Whit. (4) ,,	25.5	100×120	3768	£550	—	—	20 0	4	Worm	Dual	10 6	4 8	5 11	14 4	9¾	8 7½	3 1½	7 7	880×120	880×120
	30-50 Armstrong-Whit. (6) ,,	30.2	90×150	5724	£850	—	—	25 0	4	B or W	Dual	11 9	4 8	5 11	15 8	10	8 11½	3 1½	7 11	895×135	895×135
	11.9 Arrol-Johnston (4) Scotland	11.8	69×120	1790	£265	£285	2 or 4	15 0	4	Bevel	Mag.	9 2	4 8	5 4	12 4	7	6 8¾	2 3½	6 10½	760×90	760×90
	15.9 Arrol-Johnston (4) ,,	15.8	80×140	2811	£335	£395	5	17 0	4	Bevel	Mag.	10 3	4 8	5 7	13 3	7½	8 9½	2 7½	7 7¾	815×105	815×105
	15.9 Arrol-Johnston (4) ,,	15.8	80×140	2811	£335	£370	2	17 0	4	Bevel	Mag.	9 3	4 8	5 7	12 5	7½	7 9½	2 7½	6 7⅜	815×105	815×105
	23.9 Arrol-Johnston (6) ,,	23.8	80×120	3613	£470	£560	5	19 0	4	Bevel	Mag.	11 1	4 8	5 7	14 3	7½	8 9½	2 7½	7 7⅜	820×120	820×120
	*10 Austin (4) .... England	14.3	76×89	1616	£260	£325	4	10 2	4	Bevel	Mag.	8 3	4 0	4 7½	11 1	9½	6 8⅞	2 6	6 2¾	760×90	760×90
	*15 Austin (4) .... ,,	19.6	89×115	2864	£330	£390	4	17 0	4	Bevel	Mag.	9 3	4 6	5 4	12 6	8½	7 7	2 11½	6 11	815×105	815×105
	*18-24 Austin (4) ...... ,,	30.0	110×127	4832	£480	£575	5	21 2	4	Bevel	Dual	9 11	4 7	5 4	13 5	11	7 8	2 11½	7 1	880×120	880×120
	50 Austin (6) .... ,,	45.0	110×127	7248	£650	£740	5	24 0	4	Bevel	Dual	11 6	4 7	5 4	15 0	8½	8 4	2 11½	7 9	895×135	895×135
	*16-18 Austro-Daimler (4) Austria	15.8	80×110	2208	£390	—	—	13 2	4	Bevel	Mag.	9 8	4 1	—	13 5	10	9 7	2 9½	7 5½	815×105	815×105
	*16-25 A.-D. (4) (Alpine Model) ,,	15.8	80×110	2208	£440	—	—	13 0	4	Bevel	Mag.	9 3	4 1	—	12 10	10	8 11	2 5½	6 6½	815×105	815×105
	*20-30 A.-D. (4) (Alpine Model) ,,	20.1	90×140	3561	£525	—	—	18 0	4	Bevel	Dual	10 2	4 7	—	14 2	9	9 8½	2 9¼	7 4	820×120	820×120
	*25-35 Austro-Daimler (4) ,,	27.3	105×130	4498	£570	—	—	19 0	4	Bevel	Mag.	10 2	4 4	—	14 0	10	9 7	2 10	7 4	880×120	880×120
	*35-60 Austro-Daimler (4) ,,	35.7	120×154	6960	£750	—	—	22 2	4	Bevel	Dual	11 0	4 9	—	15 5	9	10 2	2 11½	7 8	895×135	895×135
	*27-80 A.-D. (4) (Prince Henry) ,,	27.3	105×165	5709	£875	—	—	19 3	4	Bevel	Dual	9 10	4 4½	—	13 10	10	9 1½	2 4¼	6 11¼	820×120	820×120
B	15-20 Baguley (4) ..... England	20.1	90×130	3307	£360	—	—	16 0	4	B or W	Mag.	9 6	4 4¾	5 0	12 8	10	7 9	2 6	6 8	815×105	815×105
	15-20 Baguley (4) ..... ,,	20.1	90×130	3307	£370	—	—	16 2	4	B or W	Dual	10 6	4 4¾	5 0	13 8	10	8 9	2 6	7 8	815×105	815×105
	7 Bayard (2) .... France..	6.9	75×110	970	—	£166	2	9 0	3	Bevel	Mag.	7 5	3 11½	4 9	9 5	6½	5 11½	2 4	5 3½	700×75	700×75
	8 Bayard (4) .... ,,	8.9	60×120	1360	—	£192	2	10 0	3	Bevel	Mag.	7 5	3 11½	4 9	9 5	6½	5 11½	2 4	5 3½	700×75	700×75
	10 Bayard (4) .... ,,	10.5	65×120	1592	—	£236	4	11 1	3	Bevel	Mag.	8 3½	3 11½	4 9	10 2	9	6 7	2 4	5 10½	750×85	750×85
	*11 Bayard (4) .... ,,	13.9	75×110	1940	£232	£300	4	12 0	3	Bevel	Mag.	8 10	4 1½	4 10	12 1½	7	7 7	2 8	6 8½	750×85	750×85
	14 Bayard (4) .... ,,	15.8	80×130	2610	£302	£374	4	15 0	4	Bevel	Mag.	9 5	4 5	5 2½	13 0½	7½	8 1	2 10½	7 1	810×90	810×90
	18 Bayard (4) .... ,,	17.9	85×140	3176	£352	£430	5	16 0	4	Bevel	Mag.	10 8	4 7½	5 4½	14 4½	7	8 5	2 10½	7 11	815×105	815×105
	20 Bayard (4) (Knight) ,,	20.1	90×130	3307	£460	£540	5	16 0	4	Bevel	Mag.	10 3½	4 5	5 2	13 11	7½	8 5	2 10½	7 5	815×105	815×105
	20 Bayard (4) (Knight) ,,	24.8	100×140	4396	£420	£520	5	19 0	4	Bevel	Mag.	11 0½	4 7½	5 4½	15 10	7	8 11	3 0	7 9	875×105	875×105
	*15 Bayard (6) .... ,,	18.2	70×110	2535	£300	£372	4	12 2	3	Bevel	Mag.	9 8½	4 1½	4 10	12 11½	—	7 7	2 8	—	760×90	760×90
	20 Bayard (6) .... ,,	23.8	80×120	3613	£370	£446	5	16 2	4	Bevel	Mag.	10 5	4 5	5 2	13 6	—	8 1	2 10½	—	815×105	815×105
	30 Bayard (6) .... ,,	37.2	100×140	6594	£520	£620	5	20 0	4	Bevel	Mag.	11 5½	4 7½	5 4½	15 7	7	8 11	2 10½	7 11	875×105	875×105
	10 Beacon (2) .... England	8.9	85×110	1248	—	£116	2	4 0	3	Bevel	Mag.	7 6	3 8	4 4	10 6	8	6 8	2 2	5 8	650×65	650×65
	*15-18 Bedford (4) ..... U.S.A.	22.4	95×95	2693	£175	£270	2	13 2	3	Bevel	M. Acc.	8 9	4 8	5 6	12 0	—	—		6 4¼	810×90	810×90
	*18-22 Bedford (4) ..... ,,	25.8	102×102	3328	£220	£350	4	16 0	3	Bevel	M. Acc.	9 0	4 8	5 6	12 3	—	—		6 4⅜	810×90	810×90
	*28-32 Bedford (4)	32.8	108×115	4208	£295	£470	4	20 0	3	Bevel	M. Acc.	9 7	4 8	5 9	13 6	—	—		6 5¾	880×120	880×120
	*16 Bell (4) .... England	21.0	91×120	3122	£310	£370	2	15 2	3	Bevel	Mag.	8 6	4 6	5 6	11 10	9	6 7¼	2 9½	5 10¾	810×90	810×90
	*16 Bell (4) .... ,,	21.0	91×120	3122	£325	£385	4 or 5	16 2	3	Bevel	Mag.	8 6	4 8	5 8	12 0	7½	7 8	3 0½	6 5¼	810×100	810×100
	*16 Bell (4) .... ,,	21.0	91×120	3122	£325	£395	4 or 5	17 0	3	Bevel	Mag.	9 6	4 6	5 6	13 2	7½	7 8	2 9½	6 10¾	815×105	815×105
	*20 Bell (4) .... ,,	25.4	102×140	4576	£400	£470	4 or 5	18 0	3	Bevel	Mag.	9 6	4 6	5 6	13 2	7½	7 6¼	2 9½	6 8¾	820×120	820×120

*Ariel colonial models, with ground clearance of 10in., can be supplied at an extra charge of £10. An 8 h.p. Ariel miniature car is listed in the small car section. *The 15-20 h.p. Armstrong-Whitworth complete price includes hood, screen, and five lamps. *The 10 h.p., 15 h.p., and 18-24 h.p. Austins are also made with 9ft., 9ft. 7in., and 10ft. 8in. wheelbases respectively. *The 27-80 h.p. Prince Henry Austro-Daimler has two magnetos; price quoted includes on the 16-25 h.p. Alpine model, five wire wheels (Rudge Whitworth), and on the 27-80 h.p. Prince Henry model, a speedometer. *The 14 h.p. four-cylinder and 20 h.p. six-cylinder Bayard cars are also made with three speeds. *Bedford chassis prices do not include tyres, but detachable rims; complete prices include side and tail lamps, acetylene generator, head lights, horn, and jack; the 18-22 h.p. and 28-32 h.p. prices also include hood and screen; Buick cars are similar in leading dimensions to the Bedford. *All Bell cars may be had with four speeds at an extra charge.

The Autocars of 1913.—

B (cont.)

H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity	Price: Chassis with tyres.	Price: Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space: Length	Body Space: Width	Dash to Back Wheel Centre	Tyres: Front.	Tyres: Back.
		mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft in.	mm.	mm.
*20 Bell (4) .... England	25.4	102 × 140	4576	£400	£470	4 or 5	19 0	3	Bevel	Mag.	10 3	4 6	5 6	14 0	7½	8 4¼	× 2 9½	7 4¾	820 × 120	820 × 120
*30 Bell (4) .... ,,	34.0	117 × 150	6451	£475	£545	4 or 5	20 0	3	Bevel	Dual	10 3	4 6	5 6	14 0	8	8 3	× 2 9½	7 3½	880 × 120	880 × 120
*10-12 Belsize (4) ...... England	11.8	69 × 130	1944	£185	£215	2	12 0	3	Worm	Mag.	8 1	4 3	5 3	11 4	11	7 3¼	× 2 8	5 10¼	800 × 85	800 × 85
*10-12 Belsize (4) ...... ,,	11.8	69 × 130	1944	£185	£240	4	12 0	3	Worm	Mag.	8 5	4 3	5 3	11 8	11	7 5½	× 2 8	6 2¼	800 × 85	800 × 85
*15.9 Belsize (4)........ ,,	15.8	80 × 140	2816	£260	£315	2	17 0	4	W or B	Mag.	9 0	4 4¼	5 6	12 6	10	7 9¼	× 2 8	6 9	815 × 105	815 × 105
*15.9 Belsize (4)........ ,,	15.8	80 × 140	2816	£260	£350	4	17 0	4	W or B	Mag.	9 0	4 4¼	5 6	12 6	10	7 9¼	× 2 8	6 9	815 × 105	815 × 105
14-16 Belsize (4) (land'let) ,,	21.4	93 × 120	3261	£260	£420	4	17 0	4	W or B	Mag.	8 9	4 4¼	5 6	12 6	10	7 8½	× 2 8	6 6	815 × 105	815 × 105
18-22 Belsize (6) ...... ,,	32.7	93 × 120	4891	£375	£450	4	20 0	4	W or B	M. Acc.	10 0	4 8	5 6	13 3	10	8 0½	× 2 8	6 10	820 × 120	820 × 120
16-20 Bentall (4) ...... England	24.8	100 × 95	2976	£283	£340	5	17 0	3	Bevel	Mag.	9 9	4 4	5 8	13 4	8½	7 8	× 2 6	6 8	810 × 100	810 × 100
12-20 Benz (4) .... Germany	12.8	72 × 120	1953	£325	—	—	14 0	4	Bevel	Mag.	9 4½	4 2	—	—	8	8 2	× 2 6	6 11	815 × 105	815 × 105
15-25 Benz (4) .... ,,	15.8	80 × 130	2610	£450	—	—	19 2	4	Bevel	Dual	10 4	4 8	—	—	8	8 9	× 2 10	7 6	820 × 120	820 × 120
15-25 Benz Sporting (4) ,,	15.8	80 × 130	2610	£450	—	—	17 2	4	Bevel	Dual	9 8	—	—	—	—	—		—	815 × 105	815 × 105
25-30 Benz (4) .... ,,	20.1	90 × 140	3561	£575	—	—	21 0	4	Bevel	Dual	10 6	4 8	—	—	8	9 0	× 2 11	7 6	820 × 120	820 × 120
28-35 Benz (4) .... ,,	22.4	95 × 140	3964	£625	—	—	21 1	4	Bevel	Dual	10 6	4 8	—	—	8	9 0	× 2 11	7 6	880 × 120	880 × 120
35-45 Benz (4) .... ,,	35.7	120 × 144	6496	£775	—	—	24 0	4	Bevel	Dual	11 1	4 8½	—	—	7½	9 0	× 2 11	7 8	895 × 135	895 × 135
38-60 Benz (4) .... ,,	38.8	125 × 150	7362	£850	—		25 0	4	Bevel	Dual	11 1	4 8½	—	—	7½	9 0	× 2 11	7 8	895 × 135	895 × 135
40-65 Benz (4) .... ,,	42.0	130 × 160	8480	£950	—	—	25 1	4	Bevel	Dual	11 1	4 8½	—	—	7½	9 0	× 2 11	7 8	895 × 135	895 × 135
*100 Benz (4) .... ,,	42.0	130 × 190	10080	£1150	—	—	25 1	4	Bevel	M. Acc.	11 5	4 9½	—	—	7½	8 11	× 2 5	7 8	920 × 120	935 × 135
*200 Benz (4) .... ,,	84.5	185 × 200	22010	£1800	—	—	23 0	4	Chain	Mag.	9 1	4 9½	—	—	7½	5 3	× 2 6	—	875 × 105	895 × 135
16-20 Benz Sohne (4) .. Germany	15.8	80 × 130	2610	£380	—	4 or 5	—	4	Bevel	Dual	9 8	4 6	5 7	13 6	9	8 4	× 2 8	7 1	820 × 120	820 × 120
16-20 Benz Sohne (4) .. ,,	15.8	80 × 130	2610	£390	—	4 or 5	—	4	Bevel	Dual	10 6	4 6	5 7	14 4	9	9 2	× 2 10½	7 11	820 × 120	820 × 120
16-20 Benz Sohne (4) .. ,,	17.9	85 × 115	2608	£390	—	4 or 5	13 0	4	Bevel	Dual	9 8	4 6	5 7	13 6	9	8 4	× 2 8	7 1	820 × 120	820 × 120
20-30 Benz Sohne (4) .. ,,	20.1	90 × 140	3561	£525	£625	4 or 5	13 0	4	Bevel	Dual	10 9	4 6	5 7	14 6	8	9 2	× 2 10½	7 11	820 × 120	820 × 120
18 Berkeley (4) .... England	13.9	75 × 100	1764	—	£120	2	—	3	Bevel	Mag.	8 0	4 8	—	—	10	—		—	710 × 90	710 × 90
12 Berliet (4) .... France	12.1	70 × 100	1536	£285	—	—	12 2	4	Bevel	Mag.	9 1	4 5	5 3	12 4	—	8 1	× 2 10	5 3	760 × 90	760 × 90
15 Berliet (4) .... ,,	15.8	80 × 120	2409	£370	—	—	16 2	4	Bevel	Mag.	9 7	4 5	5 3	13 2	—	8 1	× 2 10	5 7	815 × 105	815 × 105
15 Berliet (4) (long).... ,,	15.8	80 × 120	2409	£395	—	—	17 0	4	Bevel	Mag.	10 5	4 9	5 7	14 3	—	8 5	× 2 6	6 4	815 × 105	815 × 105
18 Berliet (4) .... ,,	20.1	90 × 140	3561	£460	—		17 0	4	Bevel	Mag.	10 6	4 9	5 7	14 5	—	8 3	× 2 10	5 10	880 × 120	880 × 120
18 Berliet (4) (long).... ,,	20.1	90 × 140	3561	£460	—		17 0	4	Bevel	Mag.	11 0	4 9	5 7	15 1	—	8 10	× 2 10	6 5	880 × 120	880 × 120
25 Berliet (4) .... ,,	24.8	100 × 140	4396	£495	—		19 0	4	Bevel	Mag.	10 6	4 9	5 9	14 5	—	8 3	× 2 10	5 10	880 × 120	880 × 120
25 Berliet (4) (long).... ,,	24.8	100 × 140	4396	£495			19 0	4	Bevel	Mag.	11 0	4 9	5 9	15 1	—	8 10	× 2 10	6 5	880 × 120	880 × 120
30-40 Berliet (4)....... ,,	35.7	120 × 140	6336	£650	—		21 0	4	Bevel	Mag.	10 3	4 10	5 7	14 3	—	8 5	× 3 2	5 9	880 × 120	880 × 120
30-40 Berliet (4) (long) . ,,	35.7	120 × 140	6336	£650	—	—	21 0	4	Bevel	Mag.	11 0	4 10	5 7	14 11	—	9 6	× 3 2	6 5	880 × 120	880 × 120
12-16 Bianchi (4) ..... Italy	13.9	75 × 120	2116	£325	—	-	14 2	4	Bevel	Dual	9 3	4 7	5 6	13 6	10	7 11	× 2 10	—	765 × 105	765 × 105
18 Bianchi (4) .... ,,	20.1	90 × 115	2928	£400	—	—	17 2	4	Bevel	Dual	10 2	4 7	5 7	15 0	10	8 4	× 2 10	-	815 × 105	815 × 105
18 Bianchi (4) (heavy) ,,	20.1	90 × 115	2928	£410	—	—	18 2	4	Bevel	Dual	10 2	4 7	5 7	15 0	10	8 4	× 2 10	—	820 × 120	820 × 120
25-30 Bianchi (4) ..... ,,	24.8	100 × 140	4396	£550	—	—	19 0	4	Bevel	Dual	—	—	—	—	—	—		—	880 × 120	880 × 120
30-40 Bianchi (4) ..... ,,	30.0	110 × 150	5696	£600	—	—	21 0	4	Bevel	Dual	10 6	4 10	5 8	15 8	9	8 8	× 3 0	—	880 × 120	880 × 120
40-50 Bianchi (4) ..... ,,	42.0	130 × 160	8480	£650			23 2	4	Chain	Dual	11 1	4 10	5 8	16 10	10	8 8	× 3 0	—	920 × 120	920 × 120
*70 Bianchi (4) .... ,,	42.0	130 × 150	7962	£800	—	—	21 0	4	Chain	Dual	11 1	4 10	5 8	16 10	10	8 8	× 3 0	-	920 × 120	920 × 120
*11 Brasier (4) .... France	11.1	67 × 110	1552	£266	£325	2	12 2	4	Worm	Mag.	8 8	4 3	5 2	12 4	7	7 2¾	× 2 7½	6 3½	760 × 90	760 × 90
*12 Brasier (4) .... ,,	12.1	70 × 120	1843	£300	£410	4	15 0	4	Bevel	Mag.	9 8½	4 5	5 4	13 3	8	7 6½	× 2 7½	6 11	765 × 105	765 × 105
*16 Brasier (4) .... ,,	17.9	85 × 140	3176	£400	£520	4	17 0	4	Bevel	Mag.	10 4	4 7	5 8	—	9	8 6½	× 2 9½	7 3¼	875 × 105	875 × 105
*22 Brasier (4) .... ,,	24.8	100 × 150	4704	£540	£670	4	20 0	4	Bevel	Mag.	10 10½	4 9	6 0	14 9	9½	8 10¾	× 2 11½	7 5	880 × 120	880 × 120
*24 Brasier (6) .... ,,	30.2	90 × 140	5340	£566	£716	4	23 0	4	Bevel	Mag.	10 10½	4 7	5 9	15 2	9½	8 10¾	× 2 11½	7 3½	880 × 120	880 × 120

*All Bell cars may be had with four speeds at an extra charge. *10-12 h.p. Belsize prices include side and tail lamps and horn. *The prices of the 15.9 h.p. Belsize include side and tail lamps, horn, hood, single screen, steel or wire detachable wheels with fifth wheel and spare tyre. *The 100 h.p. Benz has double spark magneto, and the 200 h.p. Benz two magnetos. *70 h.p. Bianchi has overhead valves (high speed motor). *Brasier prices include Warland dual rims; complete prices include hood, wind-screen, dashboard, petrol tank, and English body.

The Autocars of 1913.—

H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length × Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
		mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in. ft. in.	ft. in.	mm.	mm.
B (cont.) * Brenna (4) ....Germany	12.1	70×102	1568	£240	£275	4	12 0	3	Bevel	Mag.	8 11½	4 1¾	4 11	12 5½	—	—	—	810×90	810×90
* Brenna (4) .... „	15.8	80×102	2048	£300	£330	4	17 0	4	Bevel	Mag.	9 9	4 7	5 8	14 0	—	—	—	—	—
*10 Briton (4) ....England	11.3	68×120	1744	£200	£247	2	11 0	3	Bevel	Mag.	9 0	4 6	5 3	12 7	7	—	5 0	760×90	760×90
*14 Briton (4) .... „	15.8	80×120	2409	£236	£326	2	11 2	3	Bevel	Dual	9 11	4 6	5 7	13 2	8	—	6 0	810×100	810×100
25-30 Brooke (6) ......England	31.5	92×120	4788	£495	£590	5	19 0	4	Bevel	Dual	10 6	4 7	5 5	14 4	9½	8 2 ×2 10	6 10¾	880×120	880×120
40 Brooke (6) .... „	43.5	108×120	6576	£580	£675	5	21 0	4	Bevel	Dual	10 6	4 7	5 5	14 4	9½	8 2 ×2 10	6 10¾	880×120	880×120
*B.S.A. (4) ....England	13.9	75×114	2016	£250	£325	4	12 2	3	Worm	Mag.	9 4	4 8½	5 8	12 6	10½	7 0 ×2 5	6 9½	810×90	810×90
*12-20 Buchet (4) ......France	14.3	76×120	2174	£238	£275	2	14 0	3	Bevel	Mag.	8 10	4 3	5 0	12 3	4½	7 9 ×2 8	6 4	760×90	760×90
C *20-30 Cadillac (4)......U.S.A.	32.2	114×145	5921	£431	£473	5	23 0	3	Bevel	Dyn. A.	10 0	4 8	—	—	10½	—	—	880×120	880×120
12-15 Calthorpe (4) . . .England	11.8	69×125	1868	£235	£300	2 or 4	12 0	3	Bevel	Mag.	8 6	4 2	5 0	12 2	8½	7 0 ×2 7½	6 5	760×90	760×90
15 Calthorpe (4) ...... „	15.8	80×150	3012	£303	£368	4	15 0	4	Bevel	Dual	9 6	4 6	5 4	13 0	8½	7 6 ×2 9½	6 9	810×90	810×90
15 Calthorpe (4) (G'nd Prix) „	15.8	80×150	3012	—	£420	4	15 0	4	Bevel	Dual	9 6	4 6	5 4	13 0	8½	7 6 ×2 9½	6 9	815×105	815×105
15 Calthorpe (4) (de luxe) „	15.8	80×150	3012	£320	£394	5	18 0	4	Bevel	Dual	10 0	4 6	5 4	13 6	8½	8 0 ×2 9½	7 3	815×105	815×105
20 Calthorpe (4) (de luxe) „	20.1	90×150	3816	£370	£447	5	20 0	4	Bevel	Dual	10 0	4 6	5 4	13 6	8½	8 0 ×2 9½	7 3	820×120	820×120
*25 Chalmers (4) .......U.S.A.	25.8	102×114	3712	—	£365	4 or 5	—	3	Bevel	Dual	9 7	—	—	—	—	—	—	35"×3½"	35"×3½"
*11-14 Chambers (4) ...Ireland	15.6	79×102	2000	£245	£295	4	13 0	3	Worm	Mag.	8 3	4 0	5 0	12 3	8	7 0½×2 4	6 3	760×90	760×90
*12-16 Chambers (4) ... „	18.2	86×102	2368	£285	£345	5	14 0	3	Worm	Mag.	9 0	4 0	5 1	13 6	9	7 10¼×2 4	7 0	810×100	810×100
10 Charron (4) ....France	10.5	65×120	1532	£275	£350	3	10 1	3	Bevel	Mag.	8 6	4 0	5 0	12 4	7¼	6 8 ×3 0	5 11	750×85	750×85
15 Charron (4) .... „	15.8	80×120	2409	£315	£400	5	13 1	4	Bevel	Mag.	9 4½	4 4¾	5 4	13 0	7½	8 0 ×2 10	7 0	815×105	815×105
*22 Charron (4) .... „	22.4	95×130	3680	£445	£600	7	17 3	4	Bevel	Dual	10 0	4 9	5 4	14 6	6	8 6 ×2 10	7 6	820×120	820×120
*30 Charron (4) .... „	30.0	110×150	5696	£580	£700	7	21 2	4	Bevel	Dual	10 6	4 9¾	5 9	16 0	9	9 2 ×2 11	7 8½	880×120	880×120
*30 Charron (6) .... „	33.6	95×130	5520	£625	£750	7	22 2	4	Bevel	Dual	10 10	4 9¾	5 9	16 0	9	9 2 ×2 11	7 8½	880×120	880×120
*10-14 Chénard-Walcker (4) Fr'nce	11.8	69×130	1944	£265	£300	2 or 4	11 0	4	Bevel	Mag.	9 5	4 2	4 9	12 2	6½	7 6 ×2 9	6 3	800×85	800×85
*12-18 „ „ (4) (short) „	13.9	75×150	2646	£285	£360	4	15 0	4	Bevel	Mag.	9 8½	4 3½	4 9	12 10	7	7 9 ×2 9	6 7	810×90	810×90
*12-18 „ „ (4) (long) „	13.9	75×150	2646	£325	£410	5	17 0	4	Bevel	Mag.	10 5	4 5	4 11	13 8	7	8 6 ×3 0	7 3	815×105	815×105
*16-20 „ „ (4) (short) „	15.8	80×150	3012	£310	£385	4	15 0	4	Bevel	Mag.	9 8½	4 3½	4 9	12 10	7	7 9 ×2 9	6 7	815×105	815×105
*16-20 „ „ (4) (long) „	15.8	80×150	3012	£345	£430	5	17 0	4	Bevel	Mag.	10 5	4 5	4 11	13 8	7	8 6 ×3 0	7 3	820×120	820×120
*24-30 „ „ (6) „	23.8	80×150	4518	£495	£590	5	19 0	4	Bevel	Mag.	10 5	4 5	4 11	13 8	8	8 6 ×3 0	7 3	880×120	880×120
C.L.C. (1) ....France	3.9	80×140	704	£140	£145	2	8 2	3	Bevel	Mag.	6 6	4 0	4 8	9 5	9	6 3 ×2 10	—	700×70	700×70
12-14 Clément (4) .....England	13.9	75×110	1940	£290	£380	3	13 0	4	Bevel	Mag.	9 0	4 3	5 1	12 6	—	7 6¼×2 6	—	760×90	760×90
14-18 Clément (4) ..... „	20.1	90×120	3052	£350	£440	5	14 2	4	Bevel	Mag.	10 0	4 8	5 6	13 6	—	8 3 ×2 8	—	815×105	815×105
25-35 Clément (4) ..... „	28.3	107×130	4680	£500	£600	5	19 0	4	Bevel	Mag.	10 6	4 8	5 8	14 9	—	8 7½×2 10	—	880×120	880×120
35-45 Clément (4) .....France	32.8	115×140	5818	£550	£650	5	19 2	4	Bevel	Mag.	10 9	4 8	5 8	14 9	—	8 7 ×2 9½	—	880×120	880×120
20 Coltman (4) ....England	25.2	101×114	3652	£320	£385	5	17 3	4	Bevel	Dual	9 4	4 7	5 5	13 2	9	8 7 ×2 6¼	6 11	810×100	810×100
16-20 Cottin-Desgouttes (4) F'nce	15.8	80×160	3212	£390	—	—	16 3	4	Bevel	Mag.	10 1¼	4 7	—	—	10½	8 6 ×2 9¾	7 0½	815×105	815×105
20-30 Cottin-Desgouttes (4) „	24.8	100×160	5024	£510		—	18 3	4	Bevel	Mag.	10 1¼	4 7	—	—	11¾	8 7¾×2 9¾	7 2¼	880×120	880×120
*40 Cottin-Desgouttes (4) „	35.7	120×160	7232	£650	—	—	20 2	4	Chain	Mag.	10 0	4 7	—	—	11¾	8 4¼×2 9¾	6 9¼	880×120	880×120
*60 Cottin-Desgouttes (4) „	42.0	130×200	10624	£810	—	—	22 2	4	Chain	Mag.	10 2	4 7	—	—	11¾	7 9 ×2 9¾	—	880×120	880×120
10-12 Crespelle (4) ....France	10.8	65×130	1728	£245	£260	2	11 0	4	Bevel	Mag.	8 6	4 3	5 3	11 6	9½	7 0 ×2 10	6 0	710×90	710×90
12-16 Crespelle (4) .... „	13.9	75×120	2116	£285	£350	4	16 0	4	Bevel	Mag.	9 6	4 4	5 4	12 9	9½	7 8 ×2 10	6 9	760×90	760×90
14-18 Crespelle (4) .... „	13.9	75×150	2646	£300	£370	4	16 2	4	Bevel	Mag.	9 10	4 5	5 6	13 0	9½	7 9 ×2 11	6 10	760×90	760×90
15 Crossley (4) (short) England	15.6	79×120	2352	£350	£430	4	15 2	4	Bevel	Mag.	9 7	4 6	5 8	13 4	7	7 7 × —	6 7	810×90	810×90
15 Crossley (4) (long) „	15.6	79×120	2352	£370	—	—	17 0	4	Bevel	Mag.	10 4	4 6	5 8	14 1	7	8 4 × —	7 4	815×105	815×105

*Brenna complete car prices include hood, screen, three lamps, horn, steel wheels, and detachable rims; the Brenna magneto has automatic advance. *14 h.p. Briton complete car price includes dynamo lighting outfit; the 10 h.p. model, complete price includes five lamps. *B.S.A. complete car price includes hood, screen, electric side and tail lamps, and horn. *Buchet four-seater, £329; complete prices include hood and screen; Colonial chassis, with 810 × 90 mm. tyres, 9in. clearance, £15 extra. *Cadillac complete car price includes hood and screen; the dynamotor for self-starting, lighting, and ignition, is standard. *The 25 h.p. Chalmers complete price includes hood, screen, lamps, generator, horn, five rims, and compressed air starter. *Chambers cars are fitted with the Chambers easy starter. *The 22 h.p. and the two 30 h.p. Charron cars are also made with longer wheelbases. *Chénard-Walcker cars have double spark magnetos. *Both the 40 h.p. and 60 h.p. Cottin-Desgouttes are also made with longer wheelbases.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and	Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheelbase.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
				mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
C	20 Crossley (4) (short)	England	25.8	102×140	4576	£475	£575	4 to 5	22 2	4	Bevel	Dual	10 6	4 6	5 8	14 10	7	8 6	—	7 2	880×120	880×120
(cont.)	20 Crossley (4) (long)	,,	25.8	102×140	4576	£500	—	—	25 0	4	Bevel	Dual	11 3	4 6	5 8	15 7	7	9 3	—	7 11	895×135	895×135
	15 Daimler (4)	England	15.8	80×130	2610	£380	£440	—	16 2	3	Worm	Dual	10 3½	4 4	6 0	13 10	7¾	—		—	870×100	870×100
D	20 Daimler (4)	,,	20.1	90×130	3307	£430	—	4 to 6	18 0	4	Worm	Dual	10 3½	4 8½	6 0	13 10	8½	8 9½	2 7	7 6	875×105	875×105
	26 Daimler (4)	,,	25.4	102×140	4576	£575	—	4 to 6	23 0	4	Worm	Dual	11 0	4 8½	6 0	15 3	8½	9 6	2 9	7 10¼	920×120	920×120
	38 Daimler (4)	,,	38.2	124×130	6272	£625	—	4 to 6	25 0	4	Worm	Dual	11 0	4 8½	6 0	15 3	7¾	9 6	2 9	7 10¼	920×120	920×120
	30 Daimler (6)	,,	30.2	90×130	4960	£650	—	4 to 6	23 0	4	Worm	Dual	11 6½	4 8½	6 0	15 10	7¾	9 6	2 9	7 10¼	920×120	920×120
	Daimler (special 6) .	,,	39.1	102×140	6864	£850	—	4 to 6	28 0	4	Worm	Dual	11 11	4 8½	6 0	16 2	8⅝	9 6	2 9	7 10¼	935×135	935×135
	*10 Darracq (4)	France	11.3	68×120	1744	£195	£225	2	12 0	3	Bevel	Mag.	9 2	4 1	5 0	12 6	7	7 4	2 8	6 6	700×85	700×85
	*12 Darracq (4) (valveless) (long)		13.9	75×120	2116	£240	£295	—	13 0	—	Bevel	Mag.	9 5	4 1	5 0	12 8	8	7 3	2 8	6 7	760×90	760×90
	*16 Darracq (4) (valveless)		17.9	85×130	2938	£290	£350	5	15 2	4	Bevel	Mag.	9 9½	4 3¼	5 1	13 3	8	7 5	2 8	7 2	815×105	815×105
	*16 Darracq (4) ,, (extra long)		17.9	85×130	2938	£300	—	—	15 2	4	Bevel	Mag.	10 6	4 3¼	5 1	14 0	8	8 0	2 8	7 9	815×105	815×105
	22 Darracq (4) (long) ..		24.8	100×140	4396	£320	£385	5	21 0	4	Bevel	Mag.	10 4	4 6½	5 4	14 2	8½	8 0	2 9½	7 1½	880×120	880×120
	22 Darracq (4) (extra long)		24.8	100×140	4396	£330	—	—	21 2	4	Bevel	Mag.	11 0	4 6½	5 4	14 10	8½	8 8	2 9½	7 9½	880×120	880×120
	7 De Dion-Bouton (2)	France	5.4	66×120	820	£187	£242	2	—	3	Bevel	Mag.	7 0⅛	3 9¼	4 5¼	10 3¼	—	5 5½	2 7⅛	4 9¼	700×85	700×85
	12 De Dion-Bouton (4)	,,	10.8	66×120	1640	£283	—	—	13 3	3	Bevel	Mag.	8 11¼	4 1¼	4 9⅝	12 5	—	7 10½	2 9½	6 5¾	810×90	810×90
	14 De Dion-Bouton (4)	,,	13.9	75×130	2298	£355	—	—	—	3	Bevel	Mag.	9 3	4 5⅛	5 2½	13 0½	—	7 10½	2 9½	6 5¾	815×105	815×105
	14 De Dion-Bouton (4)	,,	13.9	75×130	2298	£355	—	—	—	3	Bevel	Mag.	10 0⅞	4 5⅛	5 2½	13 10⅜	—	8 8¾	2 9½	7 3¾	815×105	815×105
	*18 De Dion-Bouton (4)	,,	15.8	80×140	2816	£411	—	—	—	4	Bevel	Mag.	10 10½	4 7⅛	5 7¾	14 11⅛	—	8 8⅜	2 9½	7 8⅝	875×105	875×105
	25 De Dion-Bouton (4)	,,	24.8	100×140	4396	£507	—	—	—	4	Bevel	Mag.	11 5¾	4 9⅛	5 11½	15 9	—	9 4¼	2 11½	7 9	880×120	880×120
	25 De Dion-Bouton (4)	,,	24.8	100×140	4396	£532	—	—	—	4	Worm	Mag.	11 5¾	4 9⅛	5 11½	15 9	—	9 4¼	2 11½	7 9	880×120	880×120
	26 De Dion-Bouton (8)	,,	27.8	75×130	4596	£507	—	—	—	4	Bevel	Mag.	11 2⅝	4 7⅛	5 9½	15 3½	—	8 10¼	2 9½	7 10¾	880×120	880×120
	26 De Dion-Bouton (8)	,,	27.8	75×130	4596	£532			—	4	Worm	Mag.	11 2⅝	4 7⅛	5 9½	15 3½	—	8 10¼	2 9½	7 10¾	880×120	880×120
	50 De Dion-Bouton (8)	,,	44.0	94×140	7766	£688	—	—	—	4	Worm	Mag.	11 8⅜	4 9⅛	5 11½	16 0	—	9 6¼	2 11½	7 11½	935×135	935×135
	Delage (4)	France	10.5	65×110	1456	£221	£251	2	13 0	3	Bevel	Mag.	7 8	3 10	4 8	10 6	8	6 2	2 4	4 7	710×90	710×90
	Delage (4)	,,	10.5	65×110	1456	£248	£312	4	14 2	3	Bevel	Mag.	8 1	4 0	4 10	11 8	8½	7 0	2 4½	5 9	760×90	760×90
	Delage (4)	,,	13.9	75×120	2116	£292	£330	2	16 0	3	Bevel	Mag.	9 4	4 0	4 10	13 0	8	7 6	2 8	5 7	765×105	765×105
	Delage (4)	,,	13.9	75×130	2298	£318	£398	4	17 0	4	Bevel	Mag.	9 9	4 4	5 2	13 5	8	8 0	2 7	6 7	820×120	820×120
	Delage (6)	,,	15.9	65×125	2484	£340	£378	2	17 0	3	Bevel	Mag.	9 4	4 3	5 1	13 0	8	7 8	2 7½	5 8	815×105	815×105
	Delage (6)	,,	15.9	65×130	2592	£358	£438	4	18 0	4	Bevel	Mag.	10 7	4 5	5 1	16 0	8	8 1½	2 7½	6 10½	815×105	815×105
	8-10 Delahaye (2)	France	7.9	80×120	1205	£210	£250	2 or 4	11 0	3	Bevel	Mag.	8 10	4 4	5 2	12 2	8	7 6½	2 7½	6 6	760×90	760×90
	9-11 Delahaye (4)	,,	9.1	62×100	1208	£240	£300	2 or 4	12 0	3	Bevel	Mag.	8 10	4 3	5 2	12 2	8	7 6½	2 7½	6 6	760×90	760×90
	*12-16 Delahaye (4)	,,	13.9	75×110	1940	£286	£350	5	14 0	3 or 4	Bevel	Mag.	9 6	4 7	5 2	13 3	8	2 9	8 2½	7 6	815×105	815×105
	*16-20 Delahaye (4)	,,	17.9	85×130	2938	£390	£475	5	16 0	4	Bevel	Mag.	10 6	4 9	5 3½	14 4	8	2 9	8 8½	8 0	880×120	880×120
	*20-30 Delahaye (4)	,,	22.4	95×130	3680	£460	£550	5	18 0	4	Bevel	Mag.	10 8	4 9½	5 4	14 8	8	2 9	9 2½	8 6	880×120	880×120
	*18-24 Delahaye (6)	,,	20.9	75×120	3174	£440	£530	5	16 2	4	Bevel	Mag.	10 6	4 9	5 3½	14 4	8	—		8 0	880×120	880×120
	17 Delaunay-Belleville (4)	France	17.9	85×130	2938	£420	—	—	—	4	Bevel	Mag.	9 9	—	—	13 3	—	8 8	2 11½	—	815×105	815×105
	25 Delaunay-Belleville (4)	,,	24.8	100×140	4396	£540	—	—	—	4	Bevel	Mag.	10 6	—	—	13 10	—	8 10½	2 11½	—	880×120	880×120
	19 Delaunay-Belleville (6)	,,	19.3	72×120	2929	£480	—	—	—	4	Bevel	Mag.	10 0	—	—	13 6	—	8 8	2 11½	—	815×105	815×105
	26 Delaunay-Belleville (6)	,,	26.8	85×130	4407	£600	—	—	—	4	Bevel	Mag.	10 6	—	—	14 3	—	9 0	2 11½	—	880×120	880×120
	37 Delaunay-Belleville (6)	,,	37.2	100×140	6594	£740	—	—	—	4	Bevel	Mag.	11 2½	—	—	15 1¾	—	9 2	2 11½	—	920×120	920×120
	20 Dennis (4)	England	20.1	90×130	3307	£390	£480	6	—	4	Worm	Mag.	10 3½	4 6	—	—	10	8 4	3 0	7 5½	815×105	815×105
	24 Dennis (4)	,,	24.8	100×130	4082	£450	£540	7	—	4	Worm	Mag.	10 3½	4 6	—	—	10	8 4	3 0	7 5½	880×120	880×120
	10-12 D.F.P. (4).......	France	10.5	65×120	1592	£220	£245	2	10 0	3	Bevel	Mag.	9 0	4 0	—	11 9	6	6 10	2 6	—	750×85	750×85
	12-15 D.F.P. (4).......	,,	12.1	70×130	1996	£275	—	—	12 2	4	Bevel	Mag.	9 7	4 1	—	13 3	7	7 6	2 7½	—	760×90	760×90
	15-25 D.F.P. (4).......	,,	15.8	80×150	3012	£350	—	—	17 0	4	Bevel	Mag.	9 10	4 5	—	13 7	7	8 0	2 9	—	815×105	815×105
	12-16 Dodson (4)	England	15.8	80×120	2409	£350	—	5	16 0	4	Bevel	Mag.	9 1	4 5	5 2	13 10	9	8 1	3 0	7 1½	810×90	810×90
	20-30 Dodson (4)	,,	24.8	100×140	4396	£455	£505	5	19 0	4	Bevel	Mag.	10 2	4 7	5 5	14 7	9	8 5	3 0	7 3	880×120	880×120

*Darracq prices given for car complete include hood, screen, head lamps, side lamps, tail lamp, horn, pump, jack, and tool outfit on 10 h.p., 12 h.p., and 16 h.p. models. *The 18 h.p. De Dion may have either a live rear axle or the De Dion cardan axle. *All Delahaye cars, except the 8-10 h.p. and 9-11 h.p. models are made also with shorter wheelbases.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears.	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in. ft. in.	ft. in.	mm.	mm.
E	14.3 Enfield (4) .... England	14.3	76×120	2174	£270	£325	5	14 0	4	Bevel	Mag.	9 0	4 3	5 1	12 6	8½	7 4 ×2 6	6 4	810× 90	810× 90
	18.4 Enfield (4) .... „	18.4	86×130	3016	£307	£360	5	15 3	4	Bevel	Mag.	9 0	4 6	5 4	12 8	8½	7 4 ×2 6	6 4	815×105	815×105
	18.4 Enfield (4) .... „	18.4	86×130	3016	£317	£375	7	15 3	4	Bevel	Mag.	9 9	4 6	—	13 6	8½	8 0 ×2 6	7 0	815×105	815×105
	24·9 Enfield (4) .... „	24.8	100×130	4082	£357	£410	6	20 0	4	Bevel	Mag.	9 6	4 6	5 6	13 9	8½	8 4 ×2 8	7 0	815×105	815×105
	24.9 Enfield (4) .... „	24.8	100×130	4082	£372	£430	7	—	4	Bevel	Mag.	10 6	4 6	—	14 9	8½	9 4 ×2 8	8 0	815×105	815×105
	* Everitt (6) .... U.S.A.	38.7	102×120	3904	—	£510	5	18 0	3	Bevel	M. Acc.	10 7	4 8	5 6	15 0	11	7 9 ×2 6	6 8	915×102	915×102
	*14-20 Excelsior (4) .... Belgium	17.9	85×130	2938	£300	£375	5	16 0	3	Bevel	Mag.	9 11	4 7	5 3	13 6	8½	8 4 ×2 10	7 5	815×105	815×105
	*20-30 Excelsior (6) .... „	26.8	85×130	4407	£435	£510	5	17 2	3	Bevel	Mag.	10 8½	4 7	5 3	14 4½	·8½	8 8 ×2 10	7 9	815×105	815×105
F	F.A.B. (4) .... Belgium	13.9	75×120	2116	£300	£350	2	16 0	4	Bevel	Mag.	10 2	4 7	—	—	7¾	—	—	815×105	815×105
	F.A.B. (4) .... „	20.1	90×140	3561	£400	£475	4	18 0	4	Bevel	Mag.	10 11¾	4 7	—	—	8½	—	—	815×105	815×105
	Fafnir (4) .... Germany	10.9	66×115	1436	£205	£249	2	10 0	4	Bevel	Mag.	8 11	4 1	—	—	9	—	6 9	760× 90	760× 90
	Fafnir (4) .... „	12.1	70×125	1924	£240	£290	3	11 0	4	Bevel	Mag.	8 11	4 1	—	—	9	—	6 6	760× 90	760× 90
	Fafnir (4) .... „	15.8	80×125	2510	£310	£390	4	12 0	4	Bevel	Mag.	9 10	4 6	—	-	9	-	7 1½	815×105	815×105
	Fafnir (4) .... „	20.1	90×140	3561	£425	£525	5	17 0	4	Bevel	Mag.	11 0	4 7	—	—	10	—	7 11	880×120	880×120
	12-14 F.I.A.T. (4) ..... Italy	12.1	70×120	1843	£325	£425	4	14 1	4	Bevel	Mag.	8 11⅞	4 7⅛	5 8	12 6	7	8 1¼×2 10¾	6 10	810× 90	810× 90
	15-20 F.I.A.T. (4) ..... „	15.8	80×140	2816	£365	£465	4	15 2	4	Bevel	Mag.	8 11⅞	4 7⅛	5 8	12 6	7	8 1¼×2 10¾	6 10	815×105	815×105
	20-30 F.I.A.T. (4) ..... „	24.8	100×140	4396	£515	£665	5	23 0	4	Bevel	Mag.	10 3⅝	4 7⅛	5 9	14 0	9	8 6½×2 11½	7 6	880×120	880×120
	35-50 F.I.A.T. (4) ..... „	30.0	110×150	5696	£650	£800	5	23 2	4	Bevel	Mag.	10 3⅝	4 7⅛	6 0	14 0	9	8 6½×2 11½	7 6	880×120	880×120
	F.L. (4) .... France	15.8	80×100	2012	£325	£395	5	15 0	4	Bevel	Mag.	9 3½	4 4½	5 6¾	13 0	7	8 2 × —	6 9	815×105	815×105
	18-24 F.L. (6) .... „	23.8	80×100	3018	£475	£575	5	18 0	4	Bevel	Mag.	10 6½	4 5	5 6¾	14 1½	7	8 5 × —	—	820×120	820×120
	*18 Florio (4) .... Italy	17.9	85×130	2938	£385	£485	5	16 0	4	Bevel	Mag.	9 5	4 5½	5 5	12 6	8	8 4 ×2 10	7 2	815×105	815×105
	14-18 F.N. (4) .... Belgium	11.8	69×130	1944	—	—	—	16 0	4	Bevel	Mag.	9 6⅛	4 3⅝	—	—	8¼	7 7⅞×2 9½	6 10⅝	815×105	815×105
	16-24 F.N. (4) .... „	17.9	85×120	2712	—	—	—	20 2	4	Bevel	Mag.	10 2¾	4 8½	—	—	8	8 4⅜×2 11	7 6½	820×120	820×120
	20 Ford (4) (runabout) U.S.A.	22.4	95×102	2892	—	£135	—	8 0	2	Bevel	Mag.	8 4	4 8	5 6	11 6	10	—	—	750× 85	760× 90
	20 Ford (4) (touring) .. „	22.4	95×102	2892	—	£150	—	8 0	2	Bevel	Mag.	8 4	4 8	5 6	11 6	10	—	—	750× 85	760× 90
	20 Ford (4) (town) .... „	22.4	95×102	2892	—	£200	—	8 0	2	Bevel	Mag.	8 4	4 8	5 6	11 6	10	—	—	750× 85	760× 90
	Forest (2) .... England	8.7	84×120	1328	£136	£165	2	11 1	Fric.	Bevel	Acc.	7 4	4 0	5 0	10 6	8	7 4 ×2 6	5 6	700× 85	700× 85
	12-14 Foy Steele (4) .. England	—	76×127	—	—	£260	2	14 0	3	Bevel	Mag.	9 0	4 2	5 10	12 4	10	7 9½×3 0	7 0	800× 85	800× 85
G	*14 Germain (4) .... Belgium	21.0	92×110	2993	£325	—	—	16 0	3	Bevel	Mag.	9 9	4 1	4 11½	13 1	—	—	—	875×105	875×105
	*15 Germain (4) .... „	15.8	80×140	2816	£350	—	—	17 2	4	Bevel	Mag.	10 10	4 3	5 2	14 5	—	—	—	815×105	815×105
	*18 Germain (4) .... „	25.8	102×110	3584	£340	—	—	16 2	3	Bevel	Mag.	9 9	4 1	4 11½	13 1	—	—	—	815×105	815×105
	*20 Germain (4) .... „	21.0	92×150	3989	£420	—	—	19 2	4	Bevel	Mag.	11 6½	4 5	5 2	15 1	—	—	—	820×120	880×120
	20 Germain (4) (Knight) „	20.1	90×130	3307	£440	—	—	19 2	4	Bevel	Dual	11 2½	4 5	5 2	14 9	—	—	-	820×120	880×120
	*28 Germain (4) .... „	35.7	120×130	5876	£480	—	—	18 2	3	Bevel	Mag.	10 3	4 1	4 11½	13 5	—	—	-	880×120	880×120
	*28 Germain (4) .... „	35.7	120×130	5876	£570	—	—	22 0	4	Bevel	Mag.	10 7½	4 9	5 7	14 8½	—	—	—	880×120	880×120
	*12.1 Gladiator (4) .... France	12.1	70×110	1689	—	£295	3	15 0	3	Bevel	Mag.	8 7	4 0	—	—	9½	—	—	760× 90	760× 90
	*12.1 Gladiator (4) .... „	12.1	70×110	1689	—	£335	4	17 0	3	Bevel	Mag.	9 0	4 0	—	—	9½	—	—	760× 90	760× 90
	*15.9 Gladiator (4) .... „	15.8	80×130	2610	£330	£445	5	14 2	3	Bevel	Mag.	9 9½	4 2	—	—	9½	8 1½×—	—	815×105	815×105
	*18-28 Gladiator (4) .... „	25.3	101×130	4165	£460	£600	5	18 0	3	Bevel	Mag.	10 2	4 4	—	—	9½	—	—	820×120	820×120
	15-20 Gobron (4) ...... France	13.9	75×150	2646	£395	—	—	—	4	Bevel	Mag.	9 4¾	4 5	—	—	—	—	—	815×105	815×105
	15-20 Gobron (4) ...... „	13.9	75×150	2646	£395	—	—	—	4	Bevel	Mag.	10 3½	4 5	—	—	—	—	-	815×105	815×105
	18 Gobron (4) .... „	15.8	80×160	3212	£435	—	—	—	4	Bevel	Mag.	9 4¾	4 5	—	—	—	—	—	815×105	815×105
	20-30 Gobron (4) ...... „	20.1	90×180	4578	£580	—	—	—	4	Bevel	Mag.	10 5	4 7	—	—	—	—	—	880×120	880×120
	20-30 Gobron (4) ...... „	20.1	90×180	4578	£580	—	—	—	4	Bevel	Mag.	10 10¾	4 7	—	—	—	—	—	880×120	880×120
	40-50 Gobron (4) ...... „	30.0	110×250	8668	£960	—	—	—	4	Chain	Mag.	10 10	4 8	5 5	14 10	—	8 4 ×2 10	—	935×135	935×135
	40-50 Gobron (4) ...... „	30.0	110×250	8668	£960	—	—	—	4	Chain	Mag.	11 9	4 8	5 5	15 5	—	9 3 ×2 10	–	935×135	935×135

*The Everitt complete car price includes hood, screen, five lamps, electric outfit, and self-starter. ■Excelsior prices include five detachable wheels. *Florio price include five detachable wire wheels. *Germain magnetos have automatic advance. *All Gladiator models are fitted with Captain rims.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
G (cont.)	12 Grégoire (1) (Dumont) F'nce	6.2	100×170	1336	—	£160	2	—	Fric.	Bevel	Mag.	—	3 11½	4 6	11 8	—	—		—	750×85	750×85
	*10-14 Grégoire (4) ..... ,,	10.5	65×130	1728	£230	£290	2 to 4	—	4	Worm	Mag.	9 8	—	—	—	9½	7 4	×2 9½	—	810×90	810×90
	*14-16 Grégoire (4) ..... ,,	15.8	80×110	2208	£245	£350	2 to 5	15 0	4	B or W	Mag.	9 8	4 7	5 1	13 1	8½	7 5	×2 10	—	810×90	810×90
	*15 Grégoire (4) (Knight) ,,	15.8	80×130	2610	£375	£500	2 to 6	—	4	Worm	Mag.	10 1½	4 7	5 8	14 0	—	8 1	×2 10	—	815×105	815×105
	*16-24 Grégoire (4) ..... ,,	15.8	80×160	3212	£315	£450	2 to 6	17 0	4	Bevel	Mag.	10 5	4 7	5 8	14 6	8	8 1	×3 0	—	875×105	875×105
H	Hansa (4)..........Germany	13.9	75×90	1592	£285	£345	4	15 0	4	Bevel	Mag.	9 4	4 3	5 1	12 10	9	7 10	×2 5½	6 10	810×90	810×90
	Hansa (4).......... ,,	15.8	80×90	1808	£315	£365	4	16 0	4	Bevel	Mag.	9 4	4 3	5 1	12 10	10	7 10	×2 5½	6 10	810×90	810×90
	Hansa (4).......... ,,	15.8	80×104	2088	£340	£390	4	17 0	4	Bevel	Mag.	9 6	4 3	5 1	13 2	10	7 10	×2 5½	6 11½	810×100	810×100
	Hansa (4).......... ,,	15.8	80×104	2088	£370	£425	5	17 2	4	Bevel	Mag.	10 6	4 3	5 1	13 10	10	8 6	×2 5½	7 10½	815×105	815×105
	Hansa (4).......... ,,	19.2	88×104	2528	£400	£460	5	18 0	4	Bevel	Mag.	10 6	4 3	5 5	14 7	10	8 6½	×2 7½	7 10½	815×105	815×105
	Hansa (4).......... ,,	19.2	88×130	3160	£460	£525	5	22 0	4	Bevel	Dual	10 8	4 7	5 5	14 8	10	8 8½	×2 9½	7 6	820×120	820×120
	Hansa (4).......... ,,	22.8	96×130	2990	£535	£625	5	24 0	4	Bevel	Dual	10 8	4 7	5 5	14 8	10	8 10½	×2 9½	7 6	880×120	880×120
	10 Hillman (2) ....England	10.1	90×140	1780	£230	£290	2	13 0	3	Bevel	Mag.	9 0	4 3	5 3	12 2	7	—		—	700×85	700×85
	12-15 Hillman (4) ..... ,,	19.6	89×110	2736	£306	£342	4	15 2	3	Bevel	Mag.	9 0	4 5	5 5	12 2	8	—		6 6	760×100	760×120
	12-15 Hillman (4) ..... ,,	19.6	89×110	2736	£313	£364	5	16 0	3	Bevel	Mag.	9 8	4 5	5 5	12 10	8	—		7 2	760×100	760×120
	25 Hillman (4) .... ,,	39.99	127×127	6436	£475	£515	5	24 0	3	Bevel	Dual	10 0	4 7	5 7	13 9	8	—		6 8⅝	820×120	820×120
	25 Hillman (4) .... ,,	39.99	127×127	6436	£500	£540	5	24 2	3	Bevel	Dual	11 6	4 7	5 7	15 3	8	—		8 2⅝	820×120	820×120
	*12-20 Hispano-Suiza (4) Spain	15.8	80×110	2208	£345	—	—	13 0	3	Bevel	Mag.	9 0	4 3	4 11	—	8	7 8	×2 8	5 3	810×90	810×90
	*15-30 Hispano-Suiza (4) ,,	15.8	80×130	2610	£400	—	—	15 0	3	Bevel	Mag.	9 0	4 3	4 11	—	8	7 8	×2 8	5 3	815×105	815×105
	*30-40 Hispano-Suiza (4) ,,	24.8	100×150	4704	£570	—	—	17 0	4	Bevel	Mag.	9 10	4 7	5 3	—	8	8 2	×2 10	5 7	880×120	880×120
	*45 Hispano-Suiza (4)... ,,	15.8	80×180	3616	£450	£545	3 or 4	13 0	3	Bevel	Mag.	8 8	4 0	4 8	—	8	6 8	×2 7	4 7	815×105	815×105
	*15 H.L. (4) ....France	14.3	76×120	2174	£210	£240	4	9 0	2	Bevel	Mag.	9 0	4 4	4 11	12 3	10½	7 5	×2 4½	6 0	760×90	760×90
	Hotchkiss (4) ...... ,,	15.8	80×120	2409	£360	£430	5	17 0	4	Bevel	Mag.	9 6	4 5	5 2	12 11	9	7 11	×2 9½	6 10	815×105	815×105
	Hotchkiss (4) ...... ,,	22.4	95×130	3680	£480	£570	5	19 0	4	Bevel	Mag.	10 6	4 5	5 2	13 7	9	8 5½	×2 9½	7 8	880×120	880×120
	Hotchkiss (4) ...... ,,	30.0	110×150	5696	£600	£700	5 or 7	20 0	4	Bevel	Mag.	11 0	4 7	5 6	14 6	9½	8 11	×2 11½	7 9½	895×135	895×135
	Hotchkiss (6) ...... ,,	33.6	95×130	5522	£645	£750	5 or 7	23 0	4	Bevel	Mag.	11 2	4 7	5 6	15 5	9½	8 8	×2 11½	7 9½	895×135	895×135
	* Hudson (4) ........U.S.A.	25.8	102×133	4352	£440	£475	5	—	3	Bevel	Delco	9 10	4 8	5 6	13 10	10	7 6	×2 10	6 11½	820×120	820×120
	* Hudson (6) .... ,,	38.7	102×133	6528	£525	£595	5	—	3	Bevel	Delco	10 7	4 10	5 6	14 6	10	7 7½	×2 10	6 11½	820×120	820×120
	*11 Humber (4) ....England	11.8	69×130	1944	—	£295	2	12 0	4	Bevel	Mag.	8 11	4 7	5 2	12 0	9½	7 10½	×2 9½	6 8	810×90	810×90
	*11 Humber (4) .... ,,	11.8	69×130	1944	—	£310	4	12 0	4	Bevel	Mag.	8 11	4 7	5 2	12 0	9½	7 10½	×2 9½	6 8	810×90	810×90
	*14 Humber (4) .... ,,	13.9	75×130	2298	—	£340	2	13 0	4	Bevel	Mag.	9 2	4 7	5 2	12 3	9½	7 10½	×2 9½	6 8	815×105	815×105
	*14 Humber (4) .... ,,	13.9	75×130	2298	—	£355	4	13 0	4	Bevel	Mag.	9 2	4 7	5 2	12 3	9½	7 10½	×2 9½	6 8	815×105	815×105
	*20 Humber (4) .... ,,	20.1	90×120	3052	—	£445	5	15 3	4	Worm	M. Acc.	9 4	4 9	5 8	13 0	9¼	7 10½	×2 10	6 9½	820×120	820×120
	20 Humber (4) (land'let) ,,	20.1	90×120	3052	—	£580	6	16 0	4	Worm	M. Acc.	10 4	4 9	5 8	14 0	9¼	8 10½	×2 10	7 9½	820×120	820×120
	28 Humber (4) .... ,,	27.3	105×140	4844	—	£515	5	19 1	4	Bevel	M. Acc.	9 10	4 9	5 10	14 2½	8½	8 9½	×2 10	7 3½	820×120	820×120
	*28 Humber (4) (land'let) ,,	27.3	105×140	4844	—	£650	6	19 2	4	Bevel	M. Acc.	10 10	4 9	5 10	15 2½	8½	9 9	×2 10	8 3½	820×120	820×120
	*12 14 Hupmobile (4) ..U.S.A.	16.9	83×88	1904	—	£180	2	12 0	2	Bevel	Mag.	7 2	4 6½	5 4	9 9	9½	—		4 5	760×75	760×75
	*12-14 Hupmobile (4) .. ,,	16.9	83×88	1904	—	£210	4	15 0	2	Bevel	Mag.	9 2	4 6½	5 4	12 6	9½	—		6 5	760×75	760×75
	*15-18 Hupmobile (4) .. ,,	16.9	83×140	3032	—	£225	2	17 0	3	Bevel	Mag.	8 10	4 6½	5 4	12 0	9½	—		6 5	800×85	800×85
	*15-18 Hupmobile (4) .. ,,	16.9	83×140	3032	—	£235	4	17 2	3	Bevel	Mag.	8 10	4 6½	5 4	12 0	9½	—		6 5	810×90	810×90
	*10 Hurtu (4) ....France	12.1	70×110	1689	£215	£225	2 to 5	11 0	3	Bevel	Mag.	8 4	4 0	5 0	12 4	7	6 8	×2 9	6 2	700×70	700×90
	*14 Hurtu (4) .... ,,	13.9	75×120	2116	£245	£255	2 to 5	11 2	3	Bevel	Mag.	8 8	4 0	5 0	12 8	7	7 3	×2 9	6 6	760×90	760×90

*Grégoire chassis prices do not include tyres. *Hispano-Suiza chassis are all made in two lengths. *The H.L. car has its gears embodied in the back axle. *Hudson prices include detachable rims, Delco system of **lighting and starting**, and head lights, also screen, English hood and all extras. *11 h.p., 14 h.p., and 20 h.p. Humber open car prices include hood, screen, horn, five lamps, and spare wheel and tyre; the 20 h.p. landaulet price includes horn, five lamps, top extension, screen, and spare wheel and tyre; the 28 h.p. landaulet price includes screen, spare wheel, and tyre only. *Hupmobile complete car prices include five lamps, hood, screen, generator, horn, and tools. Hurtu colonial models with 10in. clearance, £10 extra.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in. ft. in.	ft. in.	mm.	mm.
I	15 Iris (4) ....England	15.8	80×114	2288	£350	£450	—	15 0	3	Bevel	Mag.	9 4	4 6	5 6	12 7⅜	8	7 11 ×2 10½	7 1	815×105	815×105
	15 Iris (4) (Colonial model) ,,	15.8	80×114	2288	£375	£475	—	15 0	3	Bevel	Mag.	9 4	4 6	5 6	12 7⅜	12½	7 11 ×2 10½	7 1	875×105	875×105
	25 Iris (4) .... ,,	29.0	108×133	4870	£575	£690	—	19 0	3	Bevel	Mag.	10 6	4 8	5 10	14 2	8	8 9⅝×2 9	7 5⅝	880×120	880×120
	35 Iris (4) .... ,,	39.99	127×133	6735	£700	£825	—	21 0	3	Bevel	M. Acc.	11 0	4 8	5 10	14 8	8	9 3⅝×2 9	7 11⅝	880×120	880×120
	12-15 Isotta-Fraschini (4) Italy	13.9	75×130	2298	£365	—	—	15 3	4	Bevel	Mag.	9 0	4 7⅛	5 5⅛	12 5	—	8 1¼×2 11½	5 9⅛	810×90	810×90
	16-20 Isotta-Fraschini (4) (short)	17.9	85×130	2938	£425	—	—	17 1	4	Bevel	Mag.	9 6	4 4⅜	5 3⅛	13 5	—	8 0½×2 11½	5 5¾	815×105	815×105
	16-20 Isotta-Fraschini (4) (long)	17.9	85×130	2938	£445	—	—	18 1	4	Bevel	Mag.	10 0	4 4⅜	5 3⅛	13 11	—	8 6¾×2 11½	6 0	820×120	820×120
	20-25 Isotta-Fraschini (4) (short)	24.8	100×140	4396	£565	—	—	21 1	4	Bevel	Mag.	10 4½	4 7⅛	5 7	14 3⅜	—	8 5⅝×2 11½	5 10⅛	880×120	880×120
	20-25 Isotta-Fraschini (4) (long)	24.8	100×140	4396	£585	—	—	22 0	4	Bevel	Mag.	10 8½	4 7⅛	5 7	14 7⅜	—	8 9¼×2 11½	6 2	880×120	880×120
	20-25 Isotta-Fraschini (4) (short)	24.8	100×140	4396	£565	—	—	20 0	4	Chain	Mag.	10 4½	4 7⅛	5 7	14 3⅜	—	8 5⅝×2 11½	5 10⅛	880×120	880×120
	20-25 Isotta-Fraschini (4) (long)	24.8	100×140	4396	£585	—	—	21 1	4	Chain	Mag.	10 8½	4 7⅛	5 7	14 7⅞	—	8 9¼×2 11½	6 2	880×120	880×120
	30-35 Isotta-Fraschini (4) (short)	30.0	110×160	6080	£700	—	—	24 0	4	Bevel	Mag.	10 5½	4 7⅛	5 7⅜	14 4¾	—	8 6⅜×2 11½	6 0	880×120	880×120
	30-35 Isotta-Fraschini (4) (long)	30.0	110×160	6080	£775	—	—	25 1	4	Bevel	Mag.	10 9½	4 7⅛	5 7⅜	14 8¾	--	8 10⅜×2 11½	6 3¾	895×135	895×135
	27-80 Isotta-Fraschini (4) (short)	27.3	105×180	6236	—	—	—	25 0	4	Bevel	Mag.	10 4½	4 7⅞	5 8⅛	14 1	—	8 1 ×2 11½	5 3	920×120	920×120
	27-80 Isotta-Fraschini (4) (norm'l)	27.3	105×180	6236	—	—	—	26 0	4	Bevel	Mag.	10 10¼	4 7⅞	5 8⅛	14 8	—	8 6⅜×2 11½	5 9⅝	920×120	920×120
	100 Isotta-Fraschini (4) (short)	42.0	130×200	10624	—	—	—	27 0	4	Chain	Mag.	10 4½	4 7⅞	5 8⅛	14 1	—	7 8 ×2 11½	5 1	920×120	920×120
	100 Isotta-Fraschini (4) (normal)	42.0	130×200	10624	£1195	—	—	28 0	4	Chain	Mag.	10 10¼	4 7⅞	5 8⅛	14 8	—	8 2½×2 11½	5 8⅝	935×135	935×135
	14-20 Itala (4) .... Italy	14.7	77×120	2232	£350	£440	4	15 2	4	Bevel	Mag.	9 2	4 5	4 9	12 11½	8	7 7½×2 9½	6 9½	815×105	815×105
	*18-30 Itala (4) .... ,,	20.1	90×130	3307	£460	£600	5	17 1	4	Bevel	Mag.	9 11	4 5½	5 3½	13 8½	8½	8 2½×2 9½	7 2½	815×105	815×105
	*25-35 Itala (4) .... ,,	32.8	115×130	5408	£560	—	—	22 2	4	Bevel	Mag.	10 1	4 7½	5 4½	13 11	8½	8 2½×2 11½	7 3½	870×90	880×120
	*35-45 Itala (4) .... ,,	39.9	127×140	7089	£700	—	—	23 3	4	Bevel	Mag.	10 2½	4 8	5 6	14 4½	8½	8 2½×2 11½	7 0½	870×90	895×135
	*50-65 Itala (4) .... ,,	48.6	140×150	9248	£800	—	—	25 3	4	Bevel	Mag.	10 5¼	4 8	5 6	14 7	8½	8 2½×2 11½	7 0½	875×105	895×135
	*60-70 Itala (4) .... ,,	39.9	127×160	8096	£850	—	—	23 2	4	Bevel	Mag.	10 6¼	—	—	—	—	—	—	—	—
	*120 Itala (4) .... ,,	59.6	155×160	12070	£1200	—	—	26 2	4	Bevel	Mag.	10 11	4 8	5 6	14 7	8½	8 2½×2 11½	7 0	875×105	895×135
	*25 Itala (4) (rotary valve) ,,	20.1	90×130	3307	£600	—	—	18 3	4	Bevel	Mag.	10 0¾	4 7½	5 4½	13 10½	8½	8 2½×2 11½	7 3½	815×105	815×105
	*35 Itala (4) (rotary valve) ,,	27.3	105×150	5190	£750	—	—	23 0	4	Bevel	Mag.	10 2	4 7½	5 4½	14 3¾	8½	8 2½×2 11½	7 1	880×120	880×120
	*60 Itala (6) .... ,,	59.9	130×140	11136	£960	—	—	27 0	4	Bevel	Mag.	11 1¾	4 8	5 6	15 3½	8½	8 2½×2 11½	7 0½	875×105	895×135
	*75 Itala (6) .... ,,	72.9	140×140	12912	£1000	—	—	27 2	4	Bevel	Mag.	11 1¾	4 8	5 6	15 3½	8½	8 2½×2 11½	7 0½	875×105	895×135
J	10-14 Jackson (2) .....England	8.9	85×120	1356	—	£120	3	6 2	2	Chain	Mag.	7 0	4 10½	5 6	9 6	8½	5 0 ×3 0	4 9	750×85	750×85
	13-16 Jackson (4) .....France	13.9	75×120	2116	£210	£260	3	10 2	3	Bevel	Mag.	10 0	4 6	5 0	13 6	9	8 0 ×2 6	7 0	810×90	810×90
K	Komnick (4) ....Germany	13.9	75×118	2080	—	—	4	—	3	Bevel	Mag.	—	4 3	—	—	—	—	—	760×90	760×90
	Komnick (4) .... ,,	15.8	80×130	2610	—	—	4 or 5	—	4	Bevel	Dual	10 1	4 5	—	14 2	—	8 2 × —	—	815×105	815×105
	Komnick (4) .... ,,	20.1	90×140	3561	—	—	4 or 5	—	4	Bevel	Dual	10 2	4 7	—	14 2	—	8 4 × —	—	820×120	820×120
	* Komnick (4) .... ,,	24.8	100×140	4396	—	—	4 or 5	—	4	Bevel	Dual	10 2	4 7	—	14 2	—	8 4 × —	—	870×100	880×120
	* Komnick (4) .... ,,	27.3	105×160	5536	—	—	4 or 5	—	4	Bevel	Dual	11 6	4 7	—	15 8½	—	9 0 × —	—	870×100	880×125
	*15 K.R.I.T. (4) .......U.S.A.	22.0	94×102	2760	£180	£210	5	14 2	3	Bevel	Mag.	9 0	4 8	5 6	11 9	10½	7 9 ×2 8½	6 2½	810×90	810×90
	*15 K.R.I.T. (4) .... ,,	22.0	94×102	2760	£180	£210	2	14 2	3	Bevel	Mag.	9 0	4 8	5 6	11 9	10½	7 9 ×2 8½	4 2½	810×90	810×90
L	* 8-10 La Buire (4) ....France	10.5	65×130	1728	—	—	—	13 2	4	Bevel	Mag.	8 7½	3 10¾	—	—	9	—	—	760×90	760×90
	*12 La Buire (4) .... ,,	12.1	70×150	2304	£280	—	—	14 2	4	Bevel	Mag.	8 10¼	4 4	—	—	9 to 11	—	—	810×90	810×90
	15 La Buire (4) .... ,,	15.8	80×160	3212	£350	—	—	17 2	4	Bevel	Mag.	9 5¼	4 4	—	—	9 to 11	—	—	815×105	815×105
	*20 La Buire (4) .... ,,	20.1	90×160	4070	£440	—	—	21 2	4	Bevel	Mag.	10 2	4 7	—	—	9 to 11	—	—	820×120	820×120
	*24 La Buire (6) .... ,,	26.8	85×140	4764	£520	—	—	22 0	4	Bevel	Mag.	10 8¼	4 7	—	—	9 to 11	—	—	880×120	880×120
	*28 La Buire (6) .... ,,	30.2	90×140	5342	£560	—	—	22 2	4	Bevel	Mag.	10 8¼	4 7	—	—	9 to 11	—	—	880×120	880×120
	11 Lagonda (4).......England	11.1	67×78	1100	—	£135	2	5 3	3	Bevel	Mag.	7 6	3 6	4 1	10 0	8	—	—	700×80	700×80

*All Itala models, except the 14-20 h.p., are made in two or more lengths of wheelbase. *These two Komnick cars have double spark magnetos. *K.R.I.T. complete car price includes hood, hood cover, folding screen, five lamps and generator, horn and flex, fibre mat in rear, detachable rims and spare rim, spare rim carrier, speedometer and distance recorder, tyre and tool-kits. *La Buire chassis prices do not include tyres.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
L	20 Lagonda (4)........England	20.1	90 × 120	3052	£390	£465	5	17 0	3	Worm	Mag.	10 0	4 6	5 6	13 9	10½	8 6	× 3 2	7 8	810 × 100	810 × 100
(cont.)	30 Lagonda (6)........ "	30.2	90 × 120	4578	£500	£635	5	20 0	3	Bevel	Dual	11 8	4 7	5 7	15 2	11½	9 8½	× 3 2	8 7½	875 × 105	875 × 105
	25 Lanchester (4)......England	25.6	101 × 101	3137	£550	£650	5	22 0	3	Worm	Dual	9 5	4 8½	5 4	12 9	8	7 6	× 3 2	7 3½	880 × 120	880 × 120
	25 Lanchester (4) (landa'let) "	25.6	101 × 101	3137	£575	£750	7	22 2	3	Worm	Dual	10 5	4 8½	5 4	13 9	8	8 6	× 3 2	8 3½	880 × 120	880 × 120
	25 Lanchester (4) (Colonial) "	25.6	101 × 101	3137	£550	£650	5	22 1	3	Worm	Dual	9 7	4 8½	5 4	13 2	10	7 6	× 3 2	7 3½	1020 × 120	1020 × 120
	25 Lanchester (4) (Col. lan.) "	25.6	101 × 101	3137	£575	£750	7	22 3	3	Worm	Dual	10 7	4 8½	5 4	14 2	10	8 6	× 3 2	8 3½	1020 × 120	1020 × 120
	38 Lanchester (6)...... "	38.4	101 × 101	4856	£800	£900	5	24 0	3	Worm	Dual	10 5	4 8½	5 4	13 9	8	8 6	× 3 2	8 3½	935 × 135	935 × 135
	38 Lanchester (6) (long) "	38.4	101 × 101	4856	£825	£950	7	24 2	3	Worm	Dual	11 5	4 8½	5 4	14 9	8	9 6	× 3 2	9 3½	935 × 135	935 × 135
	38 Lanchester (6) (Colonial) "	38.4	101 × 101	4856	£800	£900	5	24 1	3	Worm	Dual	10 7	4 8½	5 4	14 2	10	8 6	× 3 2	8 3½	1020 × 120	1020 × 120
	38 Lanchester (6) (Colonial) "	38.4	101 × 101	4856	£825	£950	5	24 3	3	Worm	Dual	11 7	4 8½	5 4	15 2	10	9 6	× 3 2	9 3½	1020 × 120	1020 × 120
	*30 Lancia (4) ....Italy	24.8	100 × 130	4082	£495	—	—	19 0	4	Bevel	Dual	10 6	4 5	5 6	14 0	9	9 0	× 3 0	7 11	820 × 120	820 × 120
	14-20 Léon Bollée (4) ..France	16.9	83 × 110	2368	£375	£445	5	16 0	4	Bevel	Mag.	9 7	4 6	5 6	13 2	9	—		7 5	810 × 90	810 × 90
	*20-30 Léon Bollée (6) .. "	25.6	83 × 110	3552	£545	—	—	18 0	4	Bevel	Mag.	10 2	4 6	5 6	14 0	9	—		7 1	820 × 120	820 × 120
	Licorne (4).........France	10.5	65 × 130	1728	£275	—	—	—	4	Bevel	Mag.	10 0	4 2	—	—	8½	—		—	810 × 90	810 × 90
	Licorne (4)......... "	13.9	75 × 120	2116	£200	£235	2	—	3	Bevel	Mag.	9 3	4 2	—	—	8½	—		—	800 × 85	800 × 85
	Licorne (4)......... "	13.9	75 × 120	2116	£240	—	—	—	4	Bevel	Mag.	9 3	4 2	—	—	8½	—		—	810 × 90	810 × 90
	Licorne (4)......... "	13.9	75 × 150	2646	£315	—	—	—	4	Bevel	Mag.	10 0	4 2	—	—	8½	—		—	815 × 105	815 × 105
	*12-14 Loreley (4) .....Germany	12.1	70 × 102	1568	£240	£260	2	—	3	Bevel	Mag.	9 0	4 2	—	—	—	7 7	× 2 7	6 8	760 × 90	760 × 90
	*15 Loreley (4)......... "	14.3	76 × 115	2052	£285	£310	2	—	3	Bevel	Mag.	9 6	4 5	—	—	—	8 1	× 2 7	7 2	810 × 90	810 × 100
	*12-14 Loreley (6) ..... "	13.4	60 × 92	1560	£260	£285	2	—	3	Bevel	Mag.	9 0	4 2	—	—	—	7 7	× 2 7	6 8	760 × 90	760 × 90
	*18-22 Loreley (6) ..... "	18.2	70 × 113	2610	£340	£365	2	—	3	Bevel	Mag.	9 9	—	—	—	—	—		—	815 × 105	815 × 105
	12-16 Lorraine-Dietrich (4) Fr'nce	13.9	75 × 120	2116	£329	£490	6	15 1	4	Bevel	Mag.	9 4	4 5½	5 3	12 9	7	8 0½	× 2 9⅞	—	815 × 105	815 × 105
	*12-16 Lorraine-Dietrich (4) "	13.9	75 × 120	2116	£339	£450	4	15 1	4	Bevel	Mag.	9 4	4 5½	5 3	12 9	7	7 9¼	× 2 9⅞	—	815 × 105	815 × 105
	18-20 Lorraine-Dietrich (4) "	20.1	90 × 130	3307	£441	£700	6 or 7	18 2	4	Bevel	Mag.	10 5	4 7⅛	5 6	14 4	7	8 4¾	× 2 11½	—	880 × 120	880 × 120
	*18-20 Lorraine-Dietrich (4) "	20.1	90 × 130	3307	£451	£550	4 or 5	18 2	4	Bevel	Mag.	10 5	4 7⅛	5 6	14 4	7	8 4¾	× 2 11½	—	880 × 120	880 × 120
	40 Lorraine-Dietrich (4) "	38.8	125 × 170	8343	£798	£1048	6 or 7	24 0	4	Bevel	Mag.	10 11¼	4 9	5 7¾	—	—	8 10½	× 2 11½	—	920 × 120	920 × 120
	*40 Lorraine-Dietrich (4) "	38.8	125 × 170	8343	£818	£920	4 or 5	24 0	4	Bevel	Mag.	10 3½	4 9	5 7¾	—	—	8 2¾	× 2 11½	—	920 × 120	920 × 120
M	*10-12 M.A.F. (4) ......Germany	11.3	68 × 90	1308	£190	£220	2	8 0	3	Bevel	Mag.	7 10	4 0	4 9	11 0	9	7 2	× 2 8	6 4	750 × 85	750 × 85
	*12-14 M.A.F. (4) ...... "	12.8	72 × 96	1564	£210	£230	2	9 0	3	Bevel	Mag.	9 0	4 0	4 9	11 0	9	6 2	× 2 8	7 4	760 × 90	760 × 90
	*12-14 M.A.F. (4) ...... "	12.8	72 × 96	1564	£210	£275	4 or 5	9 2	3	Bevel	Mag.	9 0	4 0	4 9	12 2	9	7 8	× 2 8	7 4	760 × 90	760 × 90
	20-25 Marathon (4)....U.S.A.	19.6	89 × 114	2836	—	£210	2	—	3	Bevel	Dual	8 8	—	—	12 0	—	—		—	810 × 90	810 × 90
	20-25 Marathon (4).... "	19.6	89 × 114	2836	—	£225	5	—	3	Bevel	Dual	8 8	—	—	12 0	—	—		—	810 × 90	810 × 90
	30-35 Marathon (4).... "	29.0	108 × 114	4160	—	£295	2	—	3	Bevel	Dual	9 8	—	—	13 2	—	—		—	875 × 105	875 × 105
	30-35 Marathon (4).... "	29.0	108 × 114	4160	—	£310	5	—	3	Bevel	Dual	9 8	—	—	13 2	—	—		—	875 × 105	875 × 105
	40-45 Marathon (4).... "	32.2	114 × 130	5312	—	£375	2	—	3	Bevel	Dual	10 3	—	—	14 2	—	—		—	915 × 105	915 × 105
	40-45 Marathon (4).... "	32.2	114 × 130	5312	—	£395	5	—	3	Bevel	Dual	10 3	—	—	14 2	—	—		—	915 × 105	915 × 105
	12-16 Martini (4) .. Switzerland	15.8	80 × 120	2409	£375	—	—	15 2	4	Bevel	Mag.	9 2½	4 3	—	—	10	8 0	× 2 7½	6 11½	810 × 90	810 × 90
	16-24 Martini (4) ..... "	20.1	90 × 140	3561	£475	—	—	17 3	4	Bevel	Mag.	9 10½	4 5	—	—	10	8 4½	× 2 9½	7 0½	815 × 105	815 × 105
	25-35 Martini (4) (Knight) "	20.1	102 × 140	4576	£590	—	—	18 0	4	Bevel	Mag.	10 0	4 5	—	—	10	8 7	× 2 9½	7 4	880 × 120	880 × 120
	10 Mass (4) ....France	13.9	75 × 100	1764	£200	£250	4	14 0	3	Bevel	Mag.	8 2	3 11	4 7	11 6	10	7 1	× 2 6	6 1	750 × 85	750 × 85
	12 Mass (4) .... "	13.9	75 × 140	2472	£250	£310	4	14 0	3	Bevel	Mag.	8 9	3 11	4 7	11 11	10	7 8	× 2 6	6 3	810 × 90	810 × 90
	15 Mass (4) .... "	20.1	90 × 150	3816	£335	£415	4	18 0	3	Bevel	Mag.	9 9	4 3	5 2	13 3	10	8 4	× 2 9	7 3	815 × 105	815 × 105
	20 Mass (4) .... "	30.0	110 × 130	4940	£475	£550	4	19 0	3	Bevel	Mag.	10 6	4 3	5 2	14 3	10	8 5	× 2 9	7 5	880 × 120	880 × 120
	25 Mass (6) .... "	23.8	80 × 180	5424	£525	£605	4	20 0	3	Bevel	Mag.	10 7	4 3	5 2	14 4	10	9 2	× 2 9	7 3	820 × 120	820 × 120

*30 h.p. Lancia chassis, with full equipment, wire wheels, patent starter, dynamo outfit, all lamps, electric horn, number-plates, speedometer, clock, etc. price £560. *The 20-30 h.p. Léon Bollée is also made with 10ft. 6in. or 10ft. 10in. wheelbase. *Loreley four-seated bodies, £15 extra. *These Lorraine-Dietrich models have specially raked steering. *The M.A.F. cars are air-cooled, and complete car prices include hood, screen, five lamps, generator, and horn.

The Autocars of 1913.—

M (*cont.*)

H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
		mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in	ft. in.	ft. in.	mm.	mm.
Mathis (Babylette) (4) Germany	8.4	58 × 90	952	£160	£175	2	7 2	3	Bevel	Mag.	6 7	3 6	4 7	—	7	—		—	650 × 65	650 × 65
Mathis (Baby) (4) ... "	10.5	65 × 100	1328	£250	£290	4	8 2	4	Bevel	Mag.	7 4	3 10	4 9	—	8	—		—	700 × 85	700 × 85
Mathis (Popular) (4) . "	10.5	65 × 110	1456	£230	£250	2	8 3	3	Bevel	Mag.	7 0	3 10	4 10	—	10	—		—	700 × 85	700 × 85
Mathis (Standard) (4) "	12.1	70 × 120	1843	£260	£325	4	10 0	4	Bevel	Mag.	7 9	3 10	4 10	—	10	—		—	750 × 85	760 × 90
18-24 Mathis (4)....... "	15.1	78 × 118	2256	£340	£375	4	15 0	4	Bevel	Mag.	8 4	4 4	4 10	—	10	—		—	810 × 90	810 × 90
20-28 Mathis (4)....... "	15.8	80 × 130	2610	£450	—	—	18 2	4	Bevel	Mag.	9 6	4 4	5 4	—	10	—		—	815 × 105	815 × 105
30-35 Mathis (4)....... "	20.1	90 × 135	3434	£550	—	—	18 3	4	Bevel	Mag.	9 6	4 6	5 4	—	10	—		—	820 × 120	820 × 120
Mathis (4) (Knight) . "	24.8	100 × 140	4396	—	—	—	—	4	Bevel	—	—	—	—	—	—	—		—	—	—
17 Maudslay (4) ......England	20.1	90 × 130	3307	£430	£560	4 or 5	18 0	4	Bevel	Dual	10 6½	4 6	5 4	14 6	7	8 6	× 3 4½	7 6	820 × 120	820 × 120
17 Maudslay (4) ...... "	20.1	90 × 130	3307	£425	£550	4 or 5	18 2	4	Bevel	Dual	10 0½	4 6	5 4	14 0	7	8 0	× 3 4½	7 0	820 × 120	820 × 120
27 Maudslay (6) ...... "	30.2	90 × 130	4960	£595	£755	4 or 5	22 0	4	Bevel	Dual	11 5½	4 6	5 4	15 6	8	8 6	× 3 4½	7 6	880 × 120	880 × 120
Maxwell Messenger (4) U.S.A.	22.5	95 × 102	2892	—	£175	2	17 0	3	Bevel	Dual	9 3	4 8	5 6	10 6	10	6 0	× 2 8	6 0	760 × 90	760 × 90
Maxwell Mascotte (4) "	25.0	102 × 102	3328	£210	£250	5	16 2	3	Bevel	Dual	8 6	4 8	5 6	12 4	11	7 0	× 2 8	6 6	810 × 90	810 × 90
*12-15 Mercédès (4).....Germany	12.1	70 × 120	1843	£350	£462	4 or 5	15 2	4	Bevel	Mag.	9 0⅝	4 3⅛	4 11	13 6	9	8 0	× 2 7½	7 1	815 × 105	815 × 105
15-20 Mercédès (4)..... "	15.8	80 × 130	2610	£450	—	2 to 7	16 3	4	Bevel	Mag.	9 11	4 5½	4 11	14 3¼	9	8 6½	× 2 9½	7 7	820 × 120	820 × 120
25-30 Mercédès (4)..... "	20.1	90 × 140	3561	£600	—	2 to 7	17 1	4	Bevel	Mag.	9 11	4 5½	4 11	14 3¼	9	8 6½	× 2 9½	7 7	820 × 120	820 × 120
*35-40 Mercédès (4) (Knight) "	24.8	100 × 130	4082	£750	—	2 to 7	18 3	4	Bevel	Mag.	10 5¼	4 5½	4 11	14 10	8	8 6½	× 2 9½	7 7	820 × 120	820 × 120
35-40 Mercédès (4) (poppet) "	30.0	110 × 150	5696	£725	—	2 to 7	24 0	4	Bevel	Mag.	11 3	4 7¾	5 5	15 7¾	8	9 0½	× 2 10⅝	8 2½	875 × 105	895 × 135
45-50 Mercédès (4)..... "	35.7	120 × 160	7232	£825	—	2 to 7	24 2	4	Bevel	Dual	11 3	4 7¾	5 6	15 7¾	9	9 0½	× 2 10⅝	8 2½	915 × 105	935 × 135
35-40 Mercédès (4) (col.) "	30.0	110 × 150	5696	£750	—	2 to 7	28 0	4	Chain	Dual	11 4¾	5 3	5 6	—	12	8 6½	× 3 4½	—	1020 × 120	1020 × 120
45-50 Mercédès (4)..... "	35.7	120 × 160	7232	£850	—	2 to 7	25 0	4	Chain	Dual	11 4¾	4 9⅛	5 6	15 6	7¾	8 6½	× 2 10⅝	8 1½	915 × 105	935 × 135
65-70 Mercédès (4)..... "	48.6	140 × 160	9856	£1125	—	2 to 7	26 0	4	Chain	Dual	11 6⅞	4 9⅛	5 6	16 0	7¾	8 6½	× 2 10⅝	8 1½	915 × 105	935 × 135
80-90 Mercédès (4)..... "	42.0	130 × 180	9568	£1275	—	2 to 7	26 0	4	Chain	Dual	11 6⅞	4 9⅛	5 6	16 3¼	7¾	8 6½	× 2 10⅝	8 1½	915 × 105	935 × 135
*10-12 Métallurgique (4) Belgium	13.9	75 × 96	1696	£270	£295	2	—	4	Bevel	Mag.	9 0	4 4	—	12 2¼	—	7 10	× —	6 6¾	760 × 90	760 × 90
15-20 Métallurgique (4) "	15.8	80 × 130	2610	£385	—	—	—	4	Bevel	Mag.	9 6¾	4 3¼	—	13 2¾	—	7 10	× —	7 1	815 × 105	815 × 105
20-30 Métallurgique (4) "	20.1	90 × 140	3561	£495	—	—	—	4	Bevel	Mag.	11 0	4 5¼	—	14 8¾	—	9 0	× —	8 1½	820 × 120	820 × 120
20-40 Métal'gique (4) (light) "	20.1	90 × 140	3561	£525	—	—	—	4	Bevel	Mag.	10 4¾	4 3¼	—	14 1	—	8 2½	× —	7 5	820 × 120	820 × 120
26-50 Métallurgique (4) "	25.8	102 × 150	4896	£625	—	—	—	4	Bevel	Mag.	11 6¼	4 8	—	15 3	—	9 4¼	× —	8 5¾	880 × 120	880 × 120
26-60 Métal'gique (4) (light) "	25.8	102 × 150	4896	£695	—	—	—	4	Bevel	Mag.	11 7	4 8	—	15 6½	—	9 4¼	× —	8 5	880 × 120	880 × 120
38-80 Métallurgique (4) "	38.8	125 × 150	7362	£875	—	—	—	4	Bevel	Mag.	12 0	4 8	—	16 6	—	9 4¼	× —	8 5	895 × 135	895 × 135
38-90 Métallurgique (4) "	38.8	125 × 150	7362	£925	—	—	—	4	Bevel	Mag.	11 0	4 8	—	14 8	—	8 0	× —	7 4	895 × 135	895 × 135
* Metz Lion (4) ......U.S.A.	22.4	95 × 102	2892	—	£125	3	9 0	Fric.	Chain	Mag.	7 6	4 8	5 6	11 0	15	—		4 6	810 × 90	810 × 90
*14 Minerva (4) ....Belgium	13.9	75 × 120	2116	£340	—	—	14 0	4	Worm	Mag.	9 5	4 3	5 0	14 0	8	8 0½	× 2 8½	—	815 × 105	815 × 105
*18 Minerva (4) .... "	20.1	90 × 130	3307	£430	—	—	18 0	4	Bevel	Dual	10 8	4 5	5 3	15 0	6½	8 10¼	× 2 9½	—	815 × 105	815 × 105
*26 Minerva (4) .... "	24.8	100 × 140	4396	£535	—	—	22 0	4	Bevel	Dual	10 6	4 8	5 7	15 0	8¼	8 6¼	× 2 11½	—	880 × 120	880 × 120
*38 Minerva (4) .... "	38.2	124 × 150	7232	£615	—	—	23 0	4	Bevel	Dual	10 9	4 8	5 7	15 6	7½	8 6¼	× 2 11½	—	880 × 120	880 × 120
Mitchell (4) ........U.S.A.	22.0	94 × 133	3692	£210	£225	2	17 0	3	Bevel	Dual	8 4	4 6½	5 9	—	9		2 7½	5 5	810 × 90	810 × 90
Mitchell (4) .... "	22.0	94 × 133	3692	£225	£300	4	18 2	3	Bevel	Dual	10 5	4 6½	5 9	—	9		2 7½	7 5	815 × 105	815 × 105
Mitchell (4) .... "	29.0	108 × 178	6528	—	—	5	21 0	3	Bevel	Dual	10 0	4 6¼	5 9	—	9		2 7½	7 5	915 × 105	915 × 105
Mitchell (6) .... "	32.9	94 × 153	6400	£340	£375	5	25 0	3	Bevel	Dual	10 5	4 6½	5 9	—	9	8 4	× 2 7½	6 5	915 × 105	915 × 105
*12-15 Mors (4) ....France	13.9	75 × 120	2116	£280	—	—	—	3	Bevel	—	—	—	—	—	—	—		—	765 × 105	765 × 105
*14-16 Mors (4) (Knight) "	13.9	75 × 120	2116	£350	—	—	—	4	Bevel	—	—	—	—	—	—	—		—	765 × 105	765 × 105
*17-20 Mors (4) .... "	17.9	85 × 150	3415	£400	—	—	—	—	Bevel	—	—	—	—	—	—	—		—	880 × 120	880 × 120
*17-20 Mors (4) (Knight) "	20.1	90 × 130	3307	£440	—	—	—	4	Bevel	—	—	—	—	—	—	—		—	880 × 120	880 × 120
*20-30 Mors (4) (Knight) "	24.8	100 × 140	4396	£600	—	—	—	4	Bevel	—	—	—	—	—	—	—		—	880 × 120	880 × 120
*35-40 Mors (4) (Knight) "	38.2	124 × 150	7232	£680	—	—	—	4	Bevel	—	—	—	—	—	—	—		—	880 × 120	880 × 120
*20-30 Mors (6) .... "	27.0	85 × 150	5123	£620	—	—	—	4	Bevel	—	—	—	—	—	—	—		—	880 × 120	880 × 120

*12-15 h.p. Mercédès complete car prices include lamps, hood, and screen, two-seater £420, landaulet £550; the 12-15 h.p. poppet and 35-40 h.p. Knight types have automatic magneto advance. *10-12 h.p. Métallurgique four-seater chassis, £280; complete price includes hood and screen and three lamps. *Metz Lion complete price includes lamps, hood, and horn. *Both the 26 h.p. and 38 h.p. Minervas can be had with longer wheelbases. All Minervas have Knight engines. *12-15 h.p. Mors, four speeds and Sankey detachable wheels £30 extra; 14-16 h.p. model includes Sankey wheels; Mors prices do not include tyres.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheelbase.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
M	10 Motobloc (4) .... France	10.5	65 × 120	1592	—	£295	2 or 4	—	3	Bevel	Mag.	8 10	4 3	—	—	8½	—		—	750 × 85	750 × 85
(cont.)	12 Motobloc (4) (runabout) ,,	15.8	80 × 120	2409	£310	—	—	—	4	Bevel	Mag.	9 1	4 6	—	—	8½	7 3	× 2 9½	—	810 × 90	810 × 90
	12 Motobloc (4) (spec'l ,,) ,,	15.8	80 × 148	2976	£360	—	—	—	4	Bevel	Mag.	9 1	4 6	—	—	8½	7 3	× 2 9½	—	815 × 105	815 × 105
	12 Motobloc (4) (long).. ..	15.8	80 × 120	2409	£310	—	—	—	4	Bevel	Mag.	9 1	4 6	—	—	8½	7 7	× 2 9½	—	810 × 90	810 × 90
	12 Motobloc (4) (spec'l long)..	15.8	80 × 148	2976	£360	-	-	—	4	Bevel	Mag.	9 1	4 6	—	—	8½	7 7	× 2 9½	—	815 × 105	815 × 105
	12 Motobloc (4) (extra long)..	15.8	80 × 120	2409	£315	—	—	—	4	Bevel	Mag.	9 9	4 6	—	—	8½	8 3	× 2 9½	—	810 × 90	810 × 90
	12 Motobloc (4) (spec'l) ,, ,	15.8	80 × 148	2976	£368	—	—	—	4	Bevel	Mag.	9 9	4 6	—	—	8½	8 3	× 2 9½	—	815 × 105	815 × 105
	16 Motobloc (4) (standard) ,.	20.1	90 × 130	3307	£417	—	—	—	4	Bevel	Mag.	10 2	4 8	—	—	8½	8 7	× 2 9½	—	815 × 105	815 × 105
	16 Motobloc (4) (special) ..	20.1	90 × 160	4070	£442	—	—	—	4	Bevel	Mag.	10 2	4 8	—	—	8½	8 7	× 2 9½	—	820 × 120	820 × 120
	16 Motobloc (6) (standard) ..	23.8	80 × 120	3613	£450	—	—	—	4	Bevel	Mag.	10 6	4 8	—	—	8½	8 7	× 2 9½	—	820 × 120	820 × 120
	20 Motobloc (6) (special) .. .	23.8	80 × 148	4464	£510	—	—	—	4	Bevel	Mag.	10 6	4 8	—	—	9	8 7	× 2 9½	—	820 × 120	820 × 120
N	N.A.G. (4) (K2 mod.) Germany	13.9	75 × 85	1500	£250	£310	4	13 0	3	Bevel	Mag.	9 2	4 6¾	5 0	12 6	7½	7 10	× —	6 6	760 × 90	760 × 90
	N.A.G. (4) (K3 mod.) ..	13.9	75 × 118	2080	£310	£370	4	15 2	4	Bevel	Mag.	9 8	4 6¾	5 0	13 0	7½	8 0	× —	6 10	815 × 105	815 × 105
	N.A.G. (4) (K4 mod.) ..	16.9	83 × 120	2600	£410	£470	4	20 0	4	Bevel	Mag.	10 5	4 8	5 6	14 0	7½	8 8	× —	7 4	820 × 120	820 × 120
	N.A.G. (4) (K5 mod.) ..	20.1	90 × 130	3307	£480	£550	4	20 0	4	Bevel	Mag.	11 0	4 8	5 9	15 0	7½	8 8	× —	7 4	820 × 120	820 × 120
	N.A.G. (4) (K6 mod.) ..	32.8	115 × 125	5194	£650	£720	4	21 0	4	Bevel	Mag.	11 1	4 8	5 9	15 0	7½	8 10	× —	7 6	880 × 120	880 × 120
	N.A.G. (4) (K8 mod.) ,,	42.0	130 × 160	8480	£775	£875	4	23 2	4	Bevel	Mag	11 1	4 8	5 9	15 0	7½	8 10	× —	7 6	895 × 135	895 × 135
	15 Napier (4) .... England	16.6	82 × 127	2684	£365	£450	4	19 2	3	Bevel	Mag.	8 10	4 11½	5 7	12 10	9½	7 5½	× 2 11½	6 6	815 × 105	815 × 105
	15 Napier (4) (Colonial) ,,	16.6	82 × 127	2084	£370	£455	4	19 2	3	Bevel	Mag.	8 10	4 11½	5 7	12 10	9½	7 5½	× 2 11½	6 6	815 × 105	815 × 105
	*15 Napier (4) (de luxe) ,,	16.6	82 × 127	2684	£395	£500	4	20 0	3	Worm	Mag.	9 10	4 8½	5 7	14 2	6½	7 7¼	× 2 11½	6 11¾	815 × 105	815 × 105
	15 Napier (4) (strong Col'l) ,,	16.6	82 × 127	2684	£398	£503	5	20 2	3	Bevel	Mag.	9 10	4 8½	5 7	14 2	11	7 7¼	× 2 11½	6 11¾	915 × 105	915 × 105
	30 Napier (6)	25.0	82 × 127	4026	£595	£730	4	23 0	3	Worm	Mag.	10 8	4 8	5 8	15 2	8	8 4	× 2 6	7 6	875 × 135	895 × 135
	45 Napier (6)	38.7	102 × 127	6840	£850	£990	4	24 2	3	Bevel	M. Acc.	11 6½	4 8	5 7	16 2	8½	8 6¼	× 2 8	7 8¾	895 × 135	895 × 135
	59.9 Napier (6) ...... ,,	59.99	127 × 127	9655	£1095	£1235	4	26 0	3	Bevel	M Acc.	11 2	4 8	5 7	15 8	6½	8 2½	× 2 8	7 5	895 × 135	895 × 135
	*20-30 Nazzaro (4) ..... Italy	24.8	100 × 140	4796	£495	£605	5	22 0	4	Bevel	Mag.	10 6	4 6	5 8	14 2	8	8 10	× 3 0	7 9	880 × 120	880 × 120
	*11.9 N.B. (4)	11.8	69 × 140	2096	£250	£350	4	14 0	4	Bevel	Mag.	9 2	4 4	5 6	12 6	8½	7 10	× 2 7	6 10	810 × 90	810 × 90
	30 N.E.C. (4) .... England	32.2	114 × 114	4640	£640	£800	6	20 0	4	Worm	M. Acc.	10 6	4 11	6 0	13 6	9½	9 2	× 3 3	10 0	920 × 120	920 × 120
	30 N.E.C. (4) .... ,,	32.2	114 × 114	4640	—	—	6	—	4	Worm	M. Acc.	11 0	4 11	6 0	14 0	9½	9 8	× 3 3	10 6	920 × 120	920 × 120
	40 N.E.C. (4) .... ,,	39.99	127 × 114	5776	£780	£840	6	22 0	4	Worm	M. Acc.	10 6	4 11	6 0	13 6	9½	9 2	× 3 3	10 0	920 × 120	920 × 120
	40 N.E.C. (4) .... ,,	39.99	127 × 114	5776	—	—	6	—	4	Worm	M. Acc.	11 6	4 11	6 0	14 6	9½	10 2	× 3 3	11 0	920 × 120	920 × 120
	20 New Pick (4) ...... England	20.1	90 × 127	3232	—	£150	2	16 0	3	Worm	Mag.	9 0	4 2	5 0	12 0	10	8 3	× 2 7	6 6	800 × 85	800 × 85
	20 New Pick (4) ...... ,,	20.1	90 × 127	3232	—	£165	4	16 0	3	Worm	Mag.	9 0	4 2	5 0	12 0	10	8 6	× 2 7	6 9	800 × 85	800 × 85
	20 New Pick (4) (Coupé) ,,	20.1	90 × 127	3232	—	£165	2	16 0	3	Worm	Mag.	9 0	4 2	5 0	12 0	10	8 3	× 2 7	6 6	800 × 85	800 × 85
	*10-12 N.S.U. (4) (short) Germany	12.1	70 × 80	1232	£195	£210	2	—	3	—	—	—	—	—	—	—	—		—	700 × 85	700 × 85
	14 N.S.U. (4)	13.9	75 × 88	1556	£250	£275	2	—	3	—	—	—	—	—	—	—	—		—	750 × 85	760 × 90
	18 N.S.U. (4) .... ,,	15.8	80 × 104	2088	£310	£350	4	—	4	—	—	—	—	—	—	—	—		—	810 × 100	810 × 100
	20 N.S.U. (4)	17.9	85 × 115	2608	£365	£425	4	—	4	—	—	—	—	—	—	—	—		—	815 × 105	815 × 105
	24 N.S.U. (4) .... ,,	23.3	97 × 115	3400	£465	£538	4	—	4	—	—	—	—	—	—	—	—		—	815 × 105	820 × 120
O	5-12 Opel (4) .... Germany	10.5	65 × 98	1300	£200	£225	2	9 3	4	Bevel	Mag.	8 0	4 2	4 11	11 5	10	6 6	× 2 6	5 8	700 × 85	700 × 85
	6-16 Opel (4) .... ,,	12.1	70 × 100	1540	£260	£300	4	11 3	4	Bevel	Mag.	9 4	4 2	5 3	12 9	10	7 6	× 2 6	6 8	760 × 90	760 × 90
	8-20 Opel (4) .... ,,	13.9	75 × 115	2032	£300	£350	4	13 3	4	Bevel	Mag.	9 6	4 3	5 3	13 5	10	7 10	× 2 6	7 0	810 × 90	810 × 90
	8-30 Opel (4) .... ,,	12.1	70 × 135	2080	—	£440	2	—	4	Bevel	Mag.	9 6	4 3	—	—	—	—		—	765 × 105	765 × 105
	10-25 Opel (4) ...... ,,	17.5	84 × 118	2616	£400	£470	6	17 3	4	Bevel	Mag.	10 9	4 6	5 10	14 9	11	8 4	× 2 9	7 4	815 × 105	815 × 105
	14-30 Opel (4) .... ,,	20.1	90 × 130	3307	£450	£520	6	19 3	4	Bevel	Mag.	11 3	4 6	5 10	14 9	11	8 4	× 2 9	7 4	815 × 105	815 × 105
	18-40 Opel (4) .... ,,	27.3	105 × 135	4676	£550	£640	7	22 3	4	Bevel	M. Acc.	11 8	4 8	5 11	16 4	11	9 0	× 2 9	7 10	870 × 90	880 × 120

*15 h.p. Napier Standard de Luxe £15 extra for four speeds. *The Nazzaro car is fitted with Harper patent detachable wheels, and £15 extra for Harper hydraulic shock absorbers: it is also made with 8ft. 6in. wheelbase. *N.B. car is fitted with Harper patent detachable wheels, and £15 each extra for Harper self-starter and hydraulic shock absorbers. *10-12 h.p. N.S.U. long chassis, £215.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheelbase.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in. ft. in.	ft. in.	mm.	mm.
O	24-50 Opel (4) ...... Germany	32.8	115×150	6228	£600	£700	7	24 2	4	Bevel	M. Acc.	12 0	4 9	6 3	16 4	12	9 0 ×3 0	8 0	875×105	895×135
(con't.)	25-55 Opel (6) .... ,,	35.7	120×144	9744	£650	£750	7	25 0	4	Bevel	M. Acc.	12 0	4 9	6 3	16 4	12	9 0 ×3 0	8 0	875×105	895×135
	34-65 Opel (6) .... ,,	42.0	130×165	12978	£700	£800	8	25 2	4	Bevel	M. Acc.	12 0	4 9	6 3	16 4	12	9 0 ×3 0	8 0	875×105	895×135
	40-100 Opel (6) .... ,,	48.6	140×165	15216	£800	£900	8	26 3	4	Bevel	M. Acc	12 0	4 9	6 3	16 4	12	9 0 ×3 0	8 0	875×105	895×135
	12-14 Oryx (4) .... Germany	13.9	75× 88	1556	£250	£300	4	17 0	3	Bevel	Mag.	8 5	4 2	5 0	13 0	10	—	—	760× 90	760× 90
	18-24 Oryx (4) .... ,,	17.9	85×115	2608	£350	£425	5	25 0	4	Bevel	Mag.	10 0	4 6	5 6	15 0	10	—	—	815×105	815×105
	20-25 Overland (4) .... U.S.A.	25.8	102×114	3712	—	£235	5	—	3	Bevel	Dual	9 2	4 8	5 6	13 10	9	7 0 ×2 8	6 3	810× 90	810× 90
	20-25 Overland (4) .... ,,	25.8	102×114	3712		£240	4	—	3	Bevel	Dual	9 2	4 8	5 6	13 10	9	7 0 ×2 8	6 3	810× 90	810× 90
	20-25 Overland (4) .... ,,	25.8	102×114	3712	—	£235	2	—	3	Bevel	Dual	9 2	4 8	5 6	12 2	9	7 0 ×2 8	6 3	810× 90	810× 90
	*25-30 Overland (4) .... ,,	30.6	111×114	4413		—	5	—	3	Bevel	M. Acc.	9 6	4 8	5 6	14 2	10	7 4 ×2 8	6 7	875×105	875×105
P	*20 Paige Detroit (4) ... U.S.A.	22.4	95×102	2892		£235	4	—	3	Bevel	Dual	8 8	—	—	—	—	—	—	810× 90	810× 90
	25 Paige Detroit (4) ... ,,	—	102×127	—	—	£295	5	—	3	Bevel	Dual	9 8	4 8	—	—	—	—	—	—	—
	*10-14 Palladium (4) Eng. & Fr'nce	10.5	65×130	1728	£198	£250	2 or 4	12 0	3	Bevel	Mag.	9 6	4 8	5 8	12 6	9	7 10 ×2 10	7 0	760× 90	760× 90
	*12-16 Palladium (4).... ,,	13.9	75×120	2116	£237	£294	2 or 4	13 0	3	Bevel	Mag.	9 6	4 8	5 8	12 6	9	7 10 ×2 10	7 0	760× 90	760× 90
	*15-18 Palladium (4).... ,,	13.9	75×150	2646	£258	£315	2 or 4	13 2	3	Bevel	Mag.	9 6	4 8	5 8	12 6	9	7 10 ×2 10	7 0	810× 90	810× 90
	*18-24 Palladium (4).... ,,	—	—	—	£300	—	7	16 2	3	Bevel	Mag.	11 0	4 8	5 8	15 0	9	9 0 ×2 10	8 0	820×120	820×120
	* Challenge (4) ,,	16.9	83×103	2232	£166	£208	2	14 0	3	Bevel	Mag.	9 6	4 8	5 8	12 6	9	7 10 ×2 10	7 0	760× 90	760× 90
	*20-28 Palladium (8).... ,,	21.0	65×130	3456	£310	—	—	16 0	3	Bevel	Mag.	9 6	4 8	5 8	12 6	9	5 6 ×2 10	5 8	815×105	815×105
	12 Panhard (4) .... France	12.1	70×140	2150	£300	—	—	14 0	4	Bevel	Mag.	9 2	4 6¾	5 5⅛	12 6¾	7	7 4¾×2 9½	6 6¾	760× 90	760× 90
	*15 Panhard (4) (de luxe) ,,	15.8	80×120	2409	£350	£450	4	16 0	4	Bevel	Mag.	10 3	4 9⅛	5 3	13 9⅜	8	8 2½×2 11½	7 3½	815×105	815×105
	25 Panhard (4) (Knight) ,,	24.8	100×140	4396	£590	—	—	19 0	4	Bevel	Mag.	11 4½	4 9¾	5 3	15 1⅛	8	9 0¾×2 11½	8 3¾	880×120	880×120
	27.3 Pathfinder (4) .... U.S.A.	27.3	105×133	4608	£420	£475	5	16 0	3	Bevel	Dual	10 0	4 4¼	5 5	14 5	9¼	— ×2 10¼	6 9½	875×105	875×105
	6 Peugeot (4) (Baby).. France	7.50	55× 90	856	—	£160	2	—	2	Bevel	Mag.	5 11	3 5	4 2	8 0	—	—	—	550× 65	550× 65
	12 Peugeot (4) (Lion, V) ,,	11.3	68×130	1888	—	£325	4	12 0	4	Bevel	Mag.	8 3	4 0	4 8	10 7	10	—		760× 90	760× 90
	12 Peugeot (4) .... ,,	12.1	70×130	1996	£315	£390	4	13 0	4	Bevel	Mag.	9 1	4 1	4 11	12 8	—	7 3 ×2 8	—	810× 90	810× 90
	15 Peugeot (4) .... ,,	15.8	80×130	2610	£360	—	4	17 0	4	Bevel	Mag.	9 10	4 2	5 0	13 4	—	8 0 ×2 9	—	815×105	815×105
	16 Peugeot (4) .... ,,	15.8	80×140	2816	£390	—	4	17 0	4	Worm	Mag.	10 6	4 7	5 2	14 0	—	8 4 ×3 0	7 3	815×105	815×105
	20 Peugeot (4) .... ,,	20.1	90×150	3816	£450		4	19 0	4	Bevel	Mag.	10 5	4 7	5 3	14 2	—	8 5 ×3 0	—	880×120	880×120
	22 Peugeot (4) .... ,,	21 0	92×150	3989	£480		4	18 0	4	Bevel	Mag.	10 4	4 2	5 0	14 0	—	8 0 ×2 10	—	820×120	820×120
	[illegible] Peugeot (4) (sporting) ,,	22.4	95×160	4536	£525		4	18 0	4	Bevel	Mag.	10 11	4 7	5 3	14 6		8 4 ×3 0	7 5	880×120	880×120
	[illegible] Peugeot (4) (long)... ,,	22.4	95×160	4536	£545		4	19 0	4	Bevel	Mag.	11 6	4 10	5 6	15 2	—	8 7 ×3 0	8 0	880×120	880×120
	[illegible]4 Peugeot (4) (extra long) ,,	22.4	95×160	4536	£560	—	4	19 0	4	Bevel	Mag.	11 10	4 10	5 6	15 6		9 3 ×3 0	8 3	880×120	880×120
	30 Peugeot (4) .... ,,	24.8	100×160	5024	£570	—	4	22 0	4	Bevel	Mag.	10 11	4 9	5 7	14 9	—	8 11 ×3 0	—	880×120	880×120
	*45 Peugeot (4) (sporting) ,,	35.7	120×200	9056	£1050	—	4	23 0	4	Bevel	Mag.	11 2	4 10	5 6	15 0	—	8 6 ×3 0	7 5	880×120	880×120
	Phanomobile (2) (V) Germany	8.3	82× 84	888	£105	£120	2	—	2	Direct	Mag	6 3	4 3	5 0	8 9	—	—	—	650× 80	650× 80
	* Phanomobile (2) ... ,,	8.3	82×110	1160	£140	£167	2	—	2	Direct	Mag.	6 6	4 3	5 0	9 3	—	—	—	700× 85	700× 85
	* Phanomobile (2) ... ,,	8.3	82×110	1160	£150	£175	2	—	2	Direct	Mag.	8 0	4 3	5 0	11 6	12	—	—	700× 85	700× 85
	* 5 Phanomobile (4) (lan'let),,	13.6	74× 90	1548	£150	£216	4	—	2	Direct	Mag.	8 0	4 3	5 0	12 0	12	—	—	710× 90	710× 90
	* 8-10 Phœnix (2) ..... England	10.1	90×100	1272	—	£195	2	9 2	3	Chain	Dual	7 0	4 0	4 10	10 4	7½	6 0 ×2 4	4 6	700× 85	700× 85
	*12.9 Phœnix (2) ...... ,,	12.9	102×115	1872	—	£220	3	12 0	3	Chain	Dual	8 0	4 0	4 10	11 4	9	7 4 ×3 1	5 6	750× 85	750× 85
	*11.9 Phœnix (4) ...... ,,	11.8	69×100	1496	£195	£230	3	10 2	3	Worm	Mag.	8 0	4 2	5 0	11 3	9	7 4 ×3 1	5 6½	750× 85	750× 85
	14 Piccard-Pictet (4) Switzerland	15.8	80×120	2409	£380	£460	4 or 5	15 0	4	Bevel	Mag.	9 6	4 5	5 7	13 8	9	8 2 ×2 10	5 9	815×105	815×105
	14 Piccard-Pictet (4) .. ,,	15.8	80×140	2816	£392	£472	4 or 5	15 0	4	Bevel	Mag.	9 6	4 5	5 7	13 8	9	8 2 ×2 10	5 9	815×105	815×105

*The 25-30 h.p. Overland accumulators are kept charged by dynamo. *The 20 h.p. Paige is fitted complete with hood, screen, five lamps, generator, horn, five detachable rims, tool-box; 25 h.p. Paige price includes hood, screen, five electric lamps, electric self-starter, horn, speedometer, spare rim, and tools. *Palladium chassis prices are less tyres; the Challenge chassis is distinct from the Palladium. *15 h.p. Panhard complete price includes hood, screen, lamps, horn, and tool-box. *The 45 h.p. Peugeot has a "valveless" engine. *Phanomobile cars have epicyclic gear and drive on single front wheel; the largest model is also made with 8ft 6in. wheelbase. *Phœnix prices include hood, screen, lamps, horn, and number-plates; and with the 11.9 h.p. spare wheel and tyre also.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
P	18 Piccard-Pictet (4) Switzerland	20.1	90×150	3816	£520	£600	4 or 5	18 0	4	Bevel	Mag.	10 8	4 8	5 10	14 7	9	8 10	×3 0	7 7	815×105	815×105
(cont.)	18 Piccard-Pictet (4) .. ,,	20.1	90×170	4328	£540	£620	2 or 4	18 0	4	Bevel	Mag.	10 6	4 8	5 10	14 5	9	7 10	×3 0	6 8	815×105	815×105
	*30 Piccard-Pictet (4) .. ,,	24.8	100×150	4704	£660	£740	5 or 7	21 0	4	Bevel	Mag.	10 9	4 8	5 10	14 11	10	8 10	×3 0	7 6	880×120	880×120
	*30 Piccard-Pictet (4)	24.8	100×150	4704	£660	£740	2 or 4	20 0	4	Bevel	Mag.	10 2	4 8	5 10	14 3	10	8 1	×3 0	6 8	880×120	880×120
	* 8-10 Pilain (4) .... France	7.5	55×110	1048	£200	—	—	10 0	4	Bevel	Mag.	8 4	4 3	—	—	—	7 11	× —	—	750×85	750×85
	*10-12 Pilain (4)	10.5	65×120	1592	£250		—	11 0	4	Bevel	Mag.	8 4	4 3	—	—	—	7 11	× —		750×85	750×85
	*12-15 Pilain (4)	13.9	75×110	1940	£290	—		13 0	4	Bevel	Mag.	9 0	4 3	—		—	8 2	×		810×90	810×90
	*16-20 Pilain (4)	20.1	90×120	3052	£330		—	14 0	4	Bevel	Mag.	9 2	4 3				7 8	×		810×90	810×90
	*16-20 Pilain (4)	20.1	90×120	3052	£390	—	—	16 0	4	Bevel	Mag.	9 8	4 7			—	8 3	× —		815×105	815×105
	*16-20 Pilain (4)	20.1	90×120	3052	£410	—	—	17 0	4	Bevel	Mag.	10 3	4 7			—	9 0	×	—	815×105	815×105
	*18-24 Pilain (4)	17.9	85×185	4200	£430		—	16 0	4	Bevel	Mag.	9 2	4 3				7 11	×	—	820×120	820×120
	*20-30 Pilain (4)	24.8	100×140	4396	£470			18 0	4	Bevel	Mag.	9 8	4 7			—	8 3	×		820×120	820×120
	*20-30 Pilain (4)	24.8	100×140	4396	£490	—		19 0	4	Bevel	Mag.	10 3	4 7		—	—	9 0	× —	—	820×120	820×120
	*28-40 Pilain (4)	38.2	124×140	6752	£570	—		24 0	4	Bevel	Mag.	10 1	4 6	—		—	8 6	× —		880×120	880×120
	*15-18 Pilain (6)	15.9	65×120	2388	£350	—		13 2	4	Bevel	Mag.	9 0	4 3		—		7 10	× —		815×105	815×105
	* Pilgrim (2) .... England	11.9	98×102	1519	£220	£270	2	13 0	3	Bevel	Dual	8 0	4 4	5 3	12 0	8¼	7 7½	×3 2	6 4½	810×90	810×90
	* Pilgrim (2) ,,	11.9	98×102	1519	£225	£295	4	14 0	3	Bevel	Dual	9 6	4 4	5 3	13 3	8¼	9 0	×3 2	7 10½	810×90	810×90
	* Pilot (4) .... England	10.5	65×110	1456	£130	£150	2	7 2	Fric.	Chain	Mag.	6 10½	3 7½	4 3	9 9	6	5 2½	×2 3½	4 3	700×80	700×80
	*12 Pipe (4) .... Belgium	13.9	75×110	1940	£280	—	—		3	Bevel	Mag.	8 10½	4 4	—	12 3	—	8 0½	×2 7½	6 8⅛	765×105	765×105
	*12-16 Pipe (4)......... ,,	13.9	75×120	2116	£312				4	Bevel	Mag.	9 7⅝	4 2		12 11⅛		8 0½	×2 7½	7 0½	815×105	815×105
	*16-20 Pipe (4)......... ,,	15.8	80×150	3012	£380				4	Bevel	Mag.	10 3¼	4 6¼		14 0½		8 4⅜	×3 1½	7 3½	820×120	820×120
	*24-30 Pipe (4)......... ,,	24.8	100×180	5664	£560				4	Bevel	Mag.	11 3¼	4 9⅛		15 4½		8 10¼	×2 11½	7 9½	880×120	880×120
	*24-30 Pipe (4) (racing) . ,,	24.8	100×180	5664	£592				4	Bevel	Mag.	10 6	4 7⅛		14 3⅝		7 10½	×2 1½	6 9½	880×120	880×120
	*30 Pipe (4) .... ,,	48.6	140×180	11072	£960				4	Chain	Dual	11 3	4 9⅞	—	14 11½	—	8 6⅜	×2 11½	7 8¼	895×135	895×135
R	12-16 R.C.H. (4) ...... U.S.A.	16.9	83×127	2744	—	£207	5	13 0	3	Bevel	Mag.	9 2	4 8	5 6	12 1	10½	7 6½	×3 6	9 11	810×90	810×90
	15.9 R.C.H. (4) .... ,,	15.8	80×127	2550	—	£225	5	13 0	3	Bevel	Mag.	9 2	4 8	5 6	12 1	10½	7 6½	×3 6	9 11	840×90	840×90
	* 9 Renault (2) (AX) .. France	15.8	80×120	2409	£173	£189	2	8 0	3	Bevel	Mag.	7 9¼	3 9¼	4 4¾	10 10¼	6½	6 6¾	×2 5½		710×90	710×90
	* 9 Renault (2) (Colonial) ..	15.8	80×120	2409	£173	£189	2	8 0	3	Bevel	Mag.	6 10½	3 9¼	4 4¾	9 10½	8	6 1	×2 5½		710×90	710×90
	* 9 Renault (2) (A.G.) . ..	15.8	80×120	2409	£234	—	4 or 5	11 1	3	Bevel	Mag.	8 5¾	4 4	5 3	12 3½	7¼	8 0½	×2 10	—	810×90	810×90
	*13.9 Renault (4) (CQ).. ..	13.9	75×120	2116	£282	£338	5	14 0	3	Bevel	Mag.	9 10	4 4¾	5 3½	13 9¾	7¼	8 0½	×2 11¾		810×90	810×90
	*15.8 Renault (4) (CB) . ..	15.8	80×130	2610	£350	£410	5	15 1	4	Bevel	Mag.	9 10½	4 4¾	5 3½	14 2	7	8 0½	×2 11¾		815×105	815×105
	*15.8 Renault (4) (camber) ..	15.8	80×130	2610	£378	—		16 2	4	Bevel	Mag.	10 9¾	—	5 3½	14 7½	7	8 8½	×2 11¾		815×105	815×105
	*20.1 Renault (4)	20.1	90×140	3561	£490			20 1	4	Bevel	Mag.	11 1¾	4 9¼	5 9¼	15 4½	7½	8 6½	×2 11¾		880×120	880×120
	*24.8 Renault (4)	24.8	100×160	5024	£578			22 2	4	Bevel	Mag.	11 10¾	4 9¼	5 9¾	16 1½	6¾	9 0¼	×2 11¾		880×120	880×120
	*45 Renault (4)	42.0	130×160	8480	£730			25 2	4	Bevel	Mag.	12 3½	4 9¼	5 9⅜	16 5¼	6½	9 0¼	×2 11¾		920×120	920×120
	*26.9 Renault (6)	27.0	85×150	5123	£590			24 0	4	Bevel	Mag.	11 9¼	4 9	5 6	16 0	7½	8 6½	×2 11¾		880×120	880×120
	*26.9 Renault (6) (long) ..	27.0	85×150	5123	£590			24 0	4	Bevel	Mag.	12 3	4 9	5 6	16 5	7½	9 0¼	×2 11¾		880×120	880×120
	*37.2 Renault (6)	63.0	130×160	12920	£730			30 0	4	Bevel	Mag.	12 10⅜	5 1½	5 10	17 1½	6½	9 0¼	×2 11¾		935×135	935×135
	*10 Riley (2) (V engine) England	11.4	96×96	1390	£214	£231	2	11 0	3	Bevel	Mag.	8 0	4 5	5 4	11 9	9½	7 2	×2 7	5 7	800×85	800×85
	*12-18 Riley (2) (V engine) ..	12.9	102×127	2058	£277	£300	2	13 0	3	Bevel	Mag.	9 0	4 5	5 4	13 2	9½	8 4	×2 7	6 10	810×90	810×90
	*12-18 Riley (2) (V engine) ..	12.9	102×127	2058	£277	£342	4	13 0	3	Bevel	Mag.	9 0	4 5	5 4	13 2	9½	8 4	×2 7	6 10	810×90	810×90
	*18-20 R.M.C. (4) ..... U.S.A.	22.4	95×114	3232	—	£225	2	19 0	3	Bevel	M. Acc.	9 0	4 8	5 8	13 0	10	—		—	810×90	810×90
	* 8-20 R.M.C. (4)	22.4	95×114	3232		£250	4	21 0	3	Bevel	M. Acc.	9 0	4 8	5 8	13 0	10				810×90	810×90
	25-30 R.M.C. (4)	29.0	108×114	4160		£350	5	—	3	Bevel	M. Acc.	9 10	4 8	5 8	—	10			—	870×100	870×100

*The 30 h.p. Piccard-Pictet has an Argyll sleeve valve engine. *Pilain prices do not include tyres. *Pilgrim cars have front drive; Pilgrim complete prices include hood, screen, and lamps. *Pilot complete price includes hood, screen, two side lamps, horn, jack, pump, and kit of tools. *Pipe prices do **not** include tyres; only the racing model has wire wheels. *All the Renaults are made with extra ground clearance for Colonial work except the 9 h.p. model; the 9 h.p. complete price includes three lamps and horn; the 13.9 h.p. and 15.8 h.p. complete prices include five lamps, generator, hood, and cover, screen, horn, tyre carrier, and number-plates; both are also made with inclined steering; the 20.1 h.p. chassis price includes back shock absorbers, and the 24.8 h.p., 26.9 h.p., 45 h.p., and 37.2 h.p. models all have four shock absorbers; no chassis weights include tyres except the 26.9 h.p. and 45 h.p. models. *Riley complete prices include hood, screen, five lamps, horn, and Riley spare wheel and tyre. *The 18-20 h.p. R.M.C. is also listed with a coupé and London built bodies; prices include acetylene generator and head lamps, electric side and tail lamps, horn, jack, and detachable rims.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price: Chassis with tyres.	Price: Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in. ft. in.	ft. in.	mm.	mm.
R (*cont.*)	40-50 Rolls-Royce (*6*) . . England	48.3	114×121	7411	£985	—	—	25 2	3	Bevel	M. Acc.	11 11½	4 8	6 0	15 9	—	8 6 ×3 0	7 8	895×135	895×135
	15 Rothwell (*4*) . . . . England	15.6	79×127	2490	£285	£350	4	16 0	3	Bevel	Mag.	9 0	4 3	5 1	12 6	8½	7 10 ×2 8	6 9	815×105	815×105
	20 Rothwell (*4*) . . . . ,,	25.6	102×127	4227	£300	£365	4	16 0	3	Bevel	Mag.	9 6	4 3	5 1	13 0	8½	7 10 ×2 8	6 9	815×105	815×105
	12 Rover (*4*) . . . . England	13.9	75×130	2298	£275	£315	5	14 0	3	Worm	Mag.	9 2	4 2	5 5	12 10	7½	7 7 ×2 6	6 8	810× 90	810× 90
	18 Rover (*4*) . . . . ,,	20.1	90×130	3307	£375	£450	5	17 0	4	Worm	Dual	10 0	4 6	5 8	13 8	8	8 2 ×2 10	7 3	820×120	820×120
S	* 8 Salmon (*4*) (light) . . England	8.06	57× 76	776	—	£100	2	5 0	2	Chain	Mag.	7 2	3 9	4 2	10 6	9	—	—	650× 65	650× 65
	* 9-11 Salmon (*4*) . . . . . ,,	11.8	69× 90	1344	£165	£230	4	7 2	3	Worm	Mag	8 0	3 9	4 2	11 6	10	8 0 ×2 8	6 6	750× 85	750 ×85
	* 9-11 Salmon (*4*) (Colonial) ,,	11.8	69× 90	1344	£165	£210	2	7 3	3	Worm	Mag.	8 0	4 4	4 9	11 6	10	8 0 ×2 8	6 6	750× 85	750× 85
	*14-18 Sava (*4*) . . . . Belgium	13.9	75×140	2472	£295	£345	5	14 0	4	Worm	Mag.	9 10⅛	4 5⅛	5 2	13 9	10	8 0½×2 9½	6 9½	815×105	815×105
	*18-26 Sava (*4*) . . . . ,,	16.6	82×140	2960	£375	£425	5	16 0	4	Worm	Mag.	11 2	4 5⅛	5 2	14 11	10	8 6⅜×2 9½	7 6	820×120	820×120
	*18-26 Sava (*4*) (Ostend) ,,	16.6	82×140	2960	£375	£425	5	14 0	4	Worm	Mag.	9 10⅛	4 5⅛	5 2	13 9	10	8 0⅛×2 9½	6 9½	820×120	820×120
	*26-32 Sava (*4*) . . . . ,,	24.8	100×160	5024	£475	£525	5	16 2	4	Worm	Mag.	12 7	4 8	5 6	15 6	10	10 7 ×2 9½	8 3⅞	880×120	880×120
	S.C.A.R. (*4*). . . . . France	15.8	80×140	2816	£331	£368	2	17 2	4	Bevel	Mag.	10 3	4 6	5 9	14 0	10	8 0 ×3 0	7 0	815×105	815×105
	S.C.A.R. (*4*). . . . . ,,	15.8	80×140	2816	£331	£394	4 or 5	18 0	4	Bevel	Mag.	10 3	4 6	5 9	14 0	10	8 0 ×3 0	7 0	815×105	815×105
	S.C.A.R. (*4*). . . . . ,,	15.8	80×140	2816	£347	£410	4 or 5	19 0	4	Bevel	Mag.	11 0	4 6	5 9	14 9	10	8 6 ×3 2	7 4	815×105	815×105
	*15 S.C.A.T. (*4*) . . . . Italy	17.9	85×130	2938	£335	£435	5	17 0	4	Bevel	Mag.	9 9	4 3	5 6	13 3	8	7 10 ×2 9	7 2	815×105	815×105
	*22 S.C.A.T. (*4*) . . . . ,,	25.6	102×140	4576	£435	£545	5	22 0	4	Bevel	Mag.	10 6	4 5	5 8	14 2	8	8 6 ×2 11	7 4½	880×120	880×120
	10-14 Schneider (*4*) . . . . France	12.1	70×120	1843	£300	£365	3	13 0	4	Bevel	Mag.	9 8	4 4	5 4	12 10	7	7 8 ×2 7	—	765×105	765×105
	12-15 Schneider (*4*) . . . . ,,	13.9	75×130	2298	£325	£410	4	14 2	4	Bevel	Mag.	9 10	4 4	5 4	13 8	7	7 10 ×2 8	—	765×105	765×105
	15-20 Schneider (*4*) . . . . ,,	15.8	80×140	2816	£375	£470	4	15 3	4	Bevel	Dual	10 4	4 6	5 6	14 4	7	8 2 ×2 11	—	815×105	815×105
	16-30 Schneider (*4*) (sport'g) ,,	17.0	83×140	3032	£450	£500	2	14 3	4	Bevel	Dual	9 8	4 6	5 6	12 10	7½	7 8 ×2 7	—	820×120	820×120
	18-24 Schneider (*4*) . . . . ,,	22.4	95×150	4250	£475	£575	5	18 2	4	Bevel	Dual	11 0	4 8	5 8	14 10	7	8 4 ×3 0	—	820×120	820×120
	25-40 Schneider (*4*) . . . . ,,	30.0	110×160	6080	£550	£650	5	20 1	4	Bevel	Dual	11 10	4 8	5 8	15 8	7	9 0 ×3 0	—	880×120	880×120
	20-25 Schneider (*6*) . . . . ,,	20.9	75×130	3447	£515	£615	7	16 2	4	Bevel	Dual	10 6	4 6	5 6	15 3	7	8 4 ×2 10	—	820×120	820×120
	10 Scout (*4*) . . . . England	11.8	69×125	1868	£245	£314	2	14 0	4	B or W	Mag.	9 0	4 3	5 3	13 5	8	7 6 ×2 7	6 10	760× 90	760× 90
	12-14 Scout (*4*). . . . . ,,	15.8	80×130	2610	£285	£380	4	14 3	4	B or W	Mag.	9 5	4 3	5 3	13 9	9	7 6 ×2 7	6 10	810× 90	810× 90
	18-22 Scout (*4*). . . . . ,,	20.1	90×140	3561	£380	£478	5	18 0	4	B or W	M. Acc.	9 8	4 8	5 8	14 6	9½	8 3 ×2 10	7 11	815×105	815×105
	24-28 Scout (*4*). . . . . ,,	25.8	102×140	4576	£460	£698	7	19 2	4	B or W	M. Acc.	9 8	4 8	5 8	14 6	9½	8 3 ×2 10	7 11	815×105	815×105
	24-28 Scout (*4*). . . . . ,,	25.8	102×140	4576	—	—	7	19 2	4	B or W	M. Acc.	10 9	4 8	5 8	15 7	9½	9 4 ×2 10	9 0	820×120	820×120
	25 Sheffield-Simplex (*6*) England	29.4	89×127	4741	£600	—	—	22 1	3	Bevel	Dual	10 6	4 8½	6 2	14 7	9	8 9¾×2 6	6 11¼	880×120	880×120
	25 Sheffield-Simplex (*6*) ,,	29.4	89×127	4741	£625	—	—	23 0¼	3	Bevel	Dual	11 3	4 8½	6 2	15 4	9	9 6¾×2 6	7 8¼	880×120	880×120
	30 Sheffield-Simplex (*6*) ,,	29.4	89×127	4741	£695	—	—	24 0	4	Worm	Dual	12 0	4 8½	6 2	16 1	8	9 3½×2 8	8 2⅜	895×135	895×135
	45 Sheffield-Simplex (*6*) ,,	48.3	114×114	6960	£750	—	—	24 2	2	Bevel	Dual	11 3	4 8½	6 2	15 4	9	9 3⅞×2 6	7 5½	895×135	895×135
	45 Sheffield-Simplex (*6*) ,,	48.3	114×114	6960	£800	—	—	25 0	2	Bevel	Dual	12 3	4 8½	6 2	16 4	9	10 3⅞×2 6	8 5½	895×135	895×135
	45 Sheffield-Simplex (*6*) ,,	48.3	114×114	6960	£800	—	—	25 3	3	Bevel	Dual	11 3	4 8½	6 2	15 4	9	9 3⅞×2 6	7 5½	895×135	895×135
	45 Sheffield-Simplex (*6*) ,,	48.3	114×114	6960	£835	—	—	26 1	3	Bevel	Dual	12 0	4 8½	6 2	16 1	9	10 0⅞×2 6	8 2½	895×135	895×135
	*14-20 Siddeley-Deasy (*4*) England	15.8	80×130	2610	£395	£480	4	17 0	4	Worm	Dual	10 4	4 8	5 7	13 2	—	8 0 ×2 10	7 3¼	815×105	815×105
	*18-24 Siddeley-Deasy (*4*) (light)	20.1	90×130	3307	£455	£540	4	18 0	4	Worm	Dual	10 8	4 8	5 7	14 4	—	8 0 ×2 10	7 6¼	815×105	815×105
	*18-24 Siddeley-Deasy (*4*)	20.1	90×130	3307	£465	£560	5	19 0	4	Worm	Dual	10 10	4 8	5 7	14 6	—	8 9 ×2 10	7 8¼	820×120	820×120
	*24-30 Siddeley-Deasy (*6*)	30.2	90×130	4960	£685	£780	5	21 0	4	Worm	Dual	11 6	4 8	5 7	15 5	—	8 9 ×2 10	7 11¼	895×135	895×135
	*10 Singer (*4*) . . . . England	9.7	63× 88	1096	—	£185	2	6 0	3	Bevel	Mag.	7 6	3 6	4 6½	10 2	9½	—	5 8	700× 80	700× 80
	14 Singer (*4*) . . . . ,,	15.1	78×125	2384	£315	£375	4	16 0	4	Bevel	Mag.	9 3	4 0½	5 6	12 10	8½	7 10½×2 6	6 8	810× 90	810× 90
	14 Singer (*4*) (speed model) ,,	15.1	78×125	2384	£345	£385	2	16 0	4	Bevel	Mag.	9 3	4 0½	5 6	12 10	8½	7 10½×2 6	6 8	810× 90	810× 90
	15 Singer (*4*) . . . . ,,	15.8	80×130	2610	£370	£430	5	18 0	4	Bevel	Mag.	9 9	4 6	5 8	13 9	6½	7 10½×2 10	6 11½	815×105	815×105
	20 Singer (*4*) . . . . ,,	20.1	90×130	3307	£425	£485	5	19 0	4	Bevel	Mag.	9 9	4 6	5 8	13 9	6	7 10½×2 10	6 11½	815×105	815×105
	20 Singer (*4*) . . . . ,,	20.1	90×130	3307	£435	£495	5	19 2	4	Bevel	Mag.	11 0	4 6	5 8	15 0	6	9 1½×2 10	7 2½	820×120	820×120
	25 Singer (*4*) . . . . ,,	24.8	100×130	4082	£525	£585	5	20 0	4	Bevel	Mag.	11 0	4 6	5 8	15 0	6	9 1½×2 10	7 2½	895×135	895×135

* The 8 h.p. Salmon has been renamed the Ace car. *The 9-11 h.p. Salmon complete car prices include hood, screen, lamps, horn, and tools. ■Sava chassis prices do not include tyres. *S.C.A.T. cars are fitted with Harper patent detachable wheels; £15 each extra for Harper self-starter and hydraulic shock absorbers. * All four Siddeley-Deasy models have Knight sleeve valve engines. *10 h.p. Singer price includes hood, screen, five lamps, horn, spare wheel and tyre.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The Autocars of 1913.—

S (*cont.*)

H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
		mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
*15-20 Sirron (4) (short) England	15.8	80 × 120	2409	£265	£305	4	12 2	3	Bevel	Mag.	8 10	4 2	4 10	12 6	9½	7 3½	× 2 8½	6 4½	760 × 90	760 × 90
*15-20 Sirron (4) (long) „	15.8	80 × 120	2409	£290	£330	4	12 3	3	Bevel	Mag.	9 3	4 5	5 0	12 11½	10	7 10	× 2 10½	6 10	810 × 90	810 × 90
*15-20 Sirron (4) (Colonial short)	15.8	80 × 120	2409	£265	£305	4	13 0	3	Bevel	Mag.	8 10	4 2	4 10	12 6	9½	7 3½	× 2 8½	6 4½	760 × 100	760 × 100
*15-20 Sirron (4) (Colonial long)	15.8	80 × 120	2409	£290	£330	4	13 2	3	Bevel	Mag.	9 3	4 5	5 0	12 11½	10	7 10	× 2 10½	6 10	810 × 100	810 × 100
*10 Sizaire (1) ....France	8.92	120 × 120	1360	—	£175	2	14 0	3	Bevel	Mag.	8 9	—	—	—	—	—		—	700 × 85	700 × 85
*15 Sizaire (4) .... „	12.1	70 × 170	2616	£270	—	—	17 0	3	Bevel	Mag.	—	—	—	—	—	—		—	810 × 90	810 × 90
12-15 S.P.A. (4) ......Italy	12.1	70 × 120	1843	£335	£390	5	12 2	4	Bevel	Mag.	8 10½	4 5	5 0	12 4	10	7 10	× 2 11	6 8½	810 × 90	810 × 90
16-20 S.P.A. (4) ...... „	17.9	85 × 120	2712	£395	£450	5	15 0	4	Bevel	Mag.	9 2	4 5	5 3	12 9	10½	8 3	× 2 11	7 2	815 × 105	815 × 105
16-20 S.P.A. (4) (long) „	17.9	85 × 120	2712	£415	£470	6	16 0	4	Bevel	Mag.	9 10	4 5	5 3	13 5	10½	9 0	× 2 11	7 11	815 × 105	815 × 105
25-30 S.P.A. (4) ...... „	24.8	100 × 140	4396	£475	£530	5	16 2	4	Bevel	Mag.	9 2	4 5	5 3	12 9	10½	7 10	× 2 11	6 9	815 × 105	815 × 105
25-30 S.P.A. (4) (long) .. „	24.8	100 × 140	4396	£495	£550	5	17 0	4	Bevel	Mag.	9 10	4 5	5 3	13 5	10½	8 7	× 2 11	7 6	815 × 105	815 × 105
25-30 S.P.A. (4) (heavy) „	24.8	100 × 140	4396	£565	£620	5	18 2	4	Bevel	Mag.	10 2	4 7	5 4	14 1	11	8 3	× 2 11	7 2	820 × 120	820 × 120
25-30 S.P.A. (4) (heavy long) „	24.8	100 × 140	4396	£585	£640	6	19 2	4	Bevel	Mag	10 10	4 7	5 4	14 9	11	9 0	× 2 11	7 11	820 × 120	820 × 120
50 S.P.A. (4)..........Italy	30.0	110 × 200	7584	£715	£770	5	19 2	4	Bevel	Mag.	10 8	4 9	5 7	14 5	11	8 7	× 2 11	7 6	880 × 120	880 × 120
50 S.P.A. (4) (long) ... „	30.0	110 × 200	7584	£735	£790	6	20 0	4	Bevel	Mag.	11 4	4 9	5 7	15 1	11	9 4	× 2 11	8 3	880 × 120	880 × 120
Springuel (4) ... Belgium	13.9	75 × 120	2116	£325	—	—	—	4	Bevel	Mag.	9 6	4 4	—	—	9			—	810 × 90	810 × 90
Springuel (4) .... „	13.9	75 × 120	2116	£325	—	—	—	4	Bevel	Mag.	10 0	4 4	—	—	9	—		—	810 × 90	810 × 90
Springuel (4) ..... „	20.1	90 × 120	3052	£420	—	—	—	4	Bevel	Mag.	9 6	4 4	—	—	9			—	815 × 105	815 × 105
Springuel (4) (long) „	20.1	90 × 120	3052	£420	—	—	—	4	Bevel	Mag.	10 0	4 4	—	—	9			—	815 × 105	815 × 105
Springuel (4) ...... „	27.9	106 × 130	4586	£555	—	—	—	4	Bevel	Mag.	10 0	4 4	—	—	9	—		—	875 × 105	875 × 105
*12 Spyker (4) .. ..Holland	11.8	69 × 120	1790	£270	—	—	15 0	4	Bevel	Mag.	9 0	4 5	5 3	12 7	8	7 10½	× 2 9½	6 9½	760 × 90	760 × 90
*14 Spyker (4) .. .. „	15.8	80 × 120	2409	£315	—	—	15 0	4	Bevel	Mag.	9 0	4 5	5 3	12 7	8	7 10½	× 2 9½	6 9½	760 × 90	760 × 90
*20 Spyker (4) .... „	20.1	90 × 135	3434	£430	—	—	18 0	4	Bevel	Mag.	10 0	4 5	5 3	13 9	8	8 6	× 2 9½	7 5	820 × 120	820 × 120
*25 Spyker (4) .... „	27.9	106 × 130	4586	£537	—	—	21 0	4	Bevel	Mag.	11 0	4 5	5 3	15 3	9½	9 2	× 2 11½	8 1	880 × 120	880 × 120
*30 Spyker (4) .. .. „	30.0	110 × 160	6080	£580	—	—	23 0	4	Bevel	Mag.	11 6	4 9	5 6	16 4	9½	9 2	× 2 11½	8 1	880 × 120	880 × 120
*40 Spyker (4) .... „	35.7	120 × 160	7232	£710	—	—	24 0	4	Bevel	Mag.	11 6	4 9	5 6	16 4	9½	9 2	× 2 11½	8 1	880 × 120	880 × 120
*25-30 Spyker (6) ...... „	30.2	90 × 110	4197	£625	—	—	21 0	3	Bevel	Mag.	11 6	4 5	5 3	15 3	9½	9 2	× 2 11½	8 1	880 × 120	880 × 120
*15 Standard (4) (Ser. X.) England	15.6	79 × 121	2368	£300	—	—	15 0	3	Worm	Mag.	9 6	4 9	5 6	13 4	9½	7 9	× 2 7½	6 9	810 × 90	810 × 90
*20 Standard (4) (Ser. O) „	19.6	89 × 134	3256	£375	£525	5	18 0	4	Worm	Mag.	10 0	4 9	5 6	14 0	9½	8 0	× 2 7½	7 1	820 × 120	820 × 120
*20 Standard (4) (Ser. O) (long)	19.6	89 × 134	3256	—	—	—	—	4	Worm	Mag.	10 6	4 9	5 6	14 6	9½	8 6	× 2 7½	7 7	820 × 120	820 × 120
10-12 Star (4) ....England	15.8	80 × 120	2409	£215	£265	4	—	3	Bevel	Mag.	8 4	4 3	5 3	11 7	7½	6 7½	× 2 7½	6 0	810 × 90	810 × 90
12-15 Star (4) .... „	15.8	80 × 120	2409	£265	£340	5	—	4	Bevel	Mag.	9 4½	4 3	5 7½	12 11½	8¾	7 0	× 2 7½	6 6	810 × 100	810 × 100
15.9 Star (4) .... „	15.8	80 × 150	3012	£300	£365	5	—	4	Bevel	Mag.	10 3½	4 9	6 1	13 11	9	8 0	× 2 10	7 1⅞	815 × 105	815 × 105
20.1 Star (4) .... „	20.1	90 × 150	3816	£340	£425	5	—	4	Bevel	Dual	10 3½	4 9	6 1	13 11	9	8 0	× 2 10	7 1⅞	820 × 120	820 × 120
25-30 Star (4) .... „	29.0	108 × 127	4544	£425	£500	5	—	4	Bevel	Dual	10 7	4 5½	5 10	14 5	10	8 6	× 2 10	7 6½	880 × 120	880 × 120
23 Star (6) .... „	23.85	80 × 120	3614	£375	£450	5	—	4	Worm	Dual	10 6	4 5½	5 10	14 5	11	8 0	× 2 10	7 1½	820 × 120	820 × 120
*Stoddard (4) (Savoy) U.S.A.	25.0	102 × 114	3712	£285	£320	5	17 2	3	Bevel	Dual	9 4	4 8	5 6	13 6	10	7 3	× 2 8	6 8	815 × 105	815 × 105
Stoewer (4) ....Germany	13.9	75 × 88	1556	£220	£250	4	14 0	4	Bevel	Mag.	8 6	4 2	4 9	11 9	8	7 2	× 2 6	—	750 × 85	750 × 85
Stoewer (4) .... „	15.8	80 × 120	2409	£325	£375	4	16 0	4	Bevel	Mag.	9 10	4 5	5 0	13 4	9	8 3	× 2 9	—	820 × 120	820 × 120
Stoewer (4) .... „	30.0	110 × 130	4940	£600	£750	4	21 0	4	Bevel	Mag.	10 9	4 9	5 6	14 10	9	9 2	× 3 0	—	880 × 125	880 × 125
12 Stoneleigh (4) (Kni't) England	13.9	75 × 114	2016	£275	£350	4	12 0	3	Worm	Mag.	9 3	4 8	—	—	—	7 0	× 2 6	6 9½	810 × 90	810 × 90
*15 Straker-Squire (4) ..England	18.8	87 × 120	2851	£326	£378	2	17 0	3	Bevel	M. or Dl	9 3	4 4	5 8	13 1½	8¼	7 9½	× 2 6	6 6½	810 × 100	810 × 100
*15 Straker-Squire (4) (runabout)	18.8	87 × 120	2851	£326	£376	2	17 0	3	Bevel	M. or Dl	9 3	4 4	5 8	13 1½	8¼	7 9½	× 2 6	6 6½	810 × 100	810 × 100
*15 Straker-Squire (4) (coupé)	18.8	87 × 120	2851	£326	£496	2	17 0	3	Worm	M. or Dl	9 3	4 4	5 8	13 1½	8¼	7 9½	× 2 6	6 6½	815 × 105	815 × 105
*15 Straker-Squire (4) ..	18.8	87 × 120	2851	£326	£414	4	17 0	3	Bevel	M. or Dl	9 3	4 4	5 8	13 1½	8¼	7 9½	× 2 6	6 6½	815 × 105	815 × 105

*Sirron Colonial models have detail differences not provided for in this table; all models have special hubs allowing purchasers the option of wire wheels with detachable rims at extra cost. *The Sizaire cars have direct drive on all three gears; chassis price does not include tyres. *Spyker prices do not include tyres. *Standard complete prices include five lamps, dynamo, speedometer, and five wheels; chassis prices include five wheels. *Stoddard car with English body, £380. *Straker-Squire Colonial model with special gear ratios, springs, radiator, petrol tank, and road wheels, road clearance 9½in., chassis price, with tyres, £343.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Cubic Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
S (con.)	*15 Straker-Squire (4) (landaulet)	18.8	87×120	2851	£326	£506	6	17 0	3	Worm	M. or Dl	9 3	4 4	5 8	13 1½	8¼	7 9½ ×	2 6	6 6½	815×105	815×105
	*15 Straker-Squire (4) (limousine)	18.8	87×120	2851	£326	£506	6	17 0	3	Worm	M. or Dl	9 3	4 4	5 8	13 1½	8¼	7 9½ ×	2 6	6 6½	815×105	815×105
	*15 Straker-Squire (4) (cabriolet)	18.8	87×120	2851	£326	£526	6	17 0	3	Worm	M. or Dl	9 3	4 4	5 8	13 1½	8¼	7 9½ ×	2 6	6 6½	815×105	815×105
	12-16 Sunbeam (4) ....England	15.8	80×150	3012	£350	£390	4	18 0	4	Bevel	Mag.	9 9⅛	4 6	5 6½	13 4¼	8	7 8¼ ×	2 8	6 10½	815×105	815×105
	12-16 Sunbeam (4) (land'let) ,,	15.8	80×150	3012	£360	—	4	18 0	4	Bevel	Mag.	10 4⅛	4 6	5 6½	13 11¼	8	8 3¼ ×	2 8	7 5½	815×105	815×105
	16-20 Sunbeam (4) .... ,,	20.1	90×160	4070	£460	£510	4	21 0	4	Bevel	Dual	10 3⅜	4 7	5 8	14 3⅜	8	7 11¼ ×	2 9½	7 1¼	820×120	820×120
	16-20 Sunbeam (4) (land'let) ,,	20.1	90×160	4070	£475	—	4	21 0	4	Bevel	Dual	10 9⅝	4 7	5 8	14 9⅝	8	8 5½ ×	2 9½	7 7½	820×120	820×120
	25-30 Sunbeam (6) .... ,,	30.2	90×160	6105	£585	£635	4	25 0	4	Bevel	Dual	11 2¼	4 7	5 8	15 4½	8	7 11¼ ×	2 9½	7 1¼	880×120	880×120
	25-30 Sunbeam (6) (land'let) ,,	30.2	90×160	6105	£600	—	4	25 0	4	Bevel	Dual	11 8½	4 7	5 8	15 10¾	8	8 5½ ×	2 9½	7 7½	880×120	880×120
	10 Swift (4)...........England	10.5	65×100	1328	£175	£195	2	—	3	Bevel	Mag.	7 8	3 9	4 8	10 7	8½	5 9½ ×	2 6	5 2½	700× 85	700× 85
	12 Swift (4)........... ,,	13.9	75×110	1940	£275	£320	4	—	4	Bevel	Mag.	9 0	4 3	5 1	12 6	8	7 5½ ×	2 6	6 7¼	760× 90	760× 90
	15 Swift (4)........... ,,	20.1	90×120	3052	£375	£450	5	—	4	Bevel	Mag.	10 0	4 8	5 7	13 9	7	8 2 ×	2 8	7 3¾	815×105	815×105
T	12 Talbot (4) ....England	15.8	80×120	2409	£350	£400	4	17 0	4	Bevel	Dual	9 4	4 3	—	—	8¼	8 0 ×	2 7½	6 7½	815×105	815×105
	12 Talbot (4) (landaulet) ,,	15.8	80×120	2409	£365	—	—	17 2	4	Bevel	Dual	10 0	4 3	—	—	8¼	8 8 ×	2 7½	7 5½	815×105	815×105
	15 Talbot (4) .... ,,	20.1	90×140	3561	£425	£495	5	20 2	4	Bevel	Dual	9 11	4 7	—	—	7½	8 0 ×	2 9½	7 0	815×105	815×105
	15 Talbot (4) (landaulet) ,,	20.1	90×140	3561	£440	—	—	20 4	4	Bevel	Dual	10 7	4 7	—	—	7½	8 8 ×	2 9½	7 8	820×120	820×120
	25 Talbot (4) .... ,,	25.8	102×140	4576	£515	£610	5	21 1	4	Bevel	Dual	9 11	4 7	—	—	7½	8 0 ×	2 9½	7 0	820×120	820×120
	25 Talbot (4) (landaulet) ,,	25.8	102×140	4576	£530	—	—	22 0	4	Bevel	Dual	10 7	4 7	—	—	7½	8 8 ×	2 9½	7 8	820×120	820×120
	20 Talbot (6) .... ,,	23.8	80×120	3614	£565	£645	5	20 3	4	Bevel	Dual	10 3¾	4 7	—	—	8¼	8 0 ×	2 9½	7 0	820×120	820×120
	20 Talbot (6) (landaulet) ,,	23.8	80×120	3614	£580	—	—	21 1	4	Bevel	Dual	10 11¾	4 7	—	—	8¼	8 8 ×	2 9½	7 8	820×120	820×120
	*18 Thornycroft (4).....England	25.2	101×114	3652	£418	£493	4 or 5	18 0	3	Worm	Mag.	10 0	4 5	5 6	14 0	4	8 4 ×	3 0	6 10½	815×105	815×105
	14 Turcat-Méry (4) ....France	15.8	80×130	2610	£360	—	—	17 0	4	Bevel	Mag.	10 1	4 5	—	—	—	—			875×105	875×105
	14 Turcat-Méry (4) (long) ,,	15.8	80×130	2610	£380	—	—	18 0	4	Bevel	Mag.	10 7½	4 5	—	—	—	—			875×105	875×105
	18 Turcat-Méry (4) .... ,,	20.1	90×130	3307	£410	—	—	18 0	4	Bevel	Mag.	10 1	4 8	—	—	—	—			880×120	880×120
	18 Turcat-Méry (4) (long) ,,	20.1	90×130	3307	£430	—	—	19 0	4	Bevel	Mag.	10 7½	4 8	—	—	—	—			880×120	880×120
	25 Turcat-Méry (4) .... ,,	24.8	100×130	4082	£520	—	—	19 0	4	Bevel	Mag.	10 4¾	4 8	—	—	—	—			880×120	880×120
	25 Turcat-Méry (4) (long) ,,	24.8	100×130	4082	£540	—	—	20 0	4	Bevel	Mag.	11 2½	4 8	—	—	—	—			880×120	880×120
	35 Turcat-Méry (4) (long) ,,	30.0	110×160	6080	£720	—	—	23 0	4	Bevel	Mag.	11 1	4 8	—	—	—	—			880×120	880×120
	9 Turner (2) ....England	10.1	90×100	1272	£140	£150	2	7 0	2	Worm	M. Acc.	6 9	4 0	4 6	9 3	9	5 10 ×	2 9	5 0	650× 65	650× 65
	10 Turner (4) .... ,,	8.9	60×100	1128	£175	£185	2	9 0	2	Worm	Mag.	8 1	4 0	4 8	10 8	9	6 5 ×	2 9	5 7	750× 80	750× 80
	10 Turner (4) .... ,,	8.9	60×100	1128	£188	£200	2 or 3	9 2	3	Worm	Mag.	8 1	4 0	4 8	10 8	9	6 8 ×	2 9	5 11	750× 80	750× 80
	10 Turner (4) .... ,,	8.9	60×100	1128	£215	£250	2 or 3	10 0	4	Worm	Mag.	8 1	4 0	4 8	10 8	9	6 8 ×	2 9	5 11	760× 90	760× 90
	12 Turner (4) .... ,,	11.8	69×110	1648	£250	£285	4	12 2	4	Worm	Mag.	9 0	4 0	4 8	12 0	9	7 10 ×	2 9	6 8	760× 90	760× 90
V	*15 Valveless (2) ....England	15.8	113×127	2502	£315	£365	5	16 0	4	Worm	Mag.	9 3	4 8	5 6	13 6	10½	7 9 ×	3 0	6 10	815×105	815×105
	*19.9 Valveless (2)...... ,,	20.0	127×127	3218	£335	£385	5	16 2	4	Worm	Mag.	9 3	4 8	5 6	13 6	10½	7 9 ×	3 0	6 10	815×105	815×105
	16-20 Vauxhall (4).....England	20.1	90×120	3052	£395	—	5	19 0	4	Bevel	Mag.	9 9	4 6	5 6	—	7	7 9 ×	2 10	6 11	815×105	815×105
	25 Vauxhall (4) .... ,,	22.4	95×140	3964	£465	—	5	23 2	4	Bevel	Mag.	10 7	4 8	5 8	—	7	8 5¼ ×	3 0	7 6¼	820×120	820×120
	25 Vauxhall (4) (Prince Henry)	22.4	95×140	3964	£495	—	4	20 0	4	Bevel	Mag.	9 9	4 6	5 6	—	7	7 9 ×	2 10	6 11	815×105	815×105
	35 Vauxhall (6)	33.6	95×120	5103	£625	—	5	25 0	4	Bevel	Dual	11 8	4 8	5 8	—	9	8 8¼ ×	3 0	7 9¼	895×135	895×135
	8-12 Vermorel (4) ....France	10.9	66×120	1640	£239	£300	4	10 2	4	Bevel	Mag.	8 2	3 11	4 9	11 6	6	7 3 ×	2 6	6 9	700× 85	700× 85
	12-16 Vermorel (4) .... ,,	13.6	74×120	2064	£285	£355	4 or 5	13 0	4	Bevel	Mag.	9 3	4 2	5 0	12 10	6	8 0 ×	2 8	7 2	760× 90	760× 90
	12 Vermorel (4) (Colonial) ,,	13.6	74×120	2064	£285	£355	4 or 5	13 0	4	Bevel	Mag.	9 3	4 2	5 0	12 10	8½	8 0 ×	2 8	7 2	810× 90	810× 90
	*12-14 Vinot (4)........France	12.1	70×110	1689	—	£295	3	15 0	3	Bevel	Mag.	8 7	4 0	—	—	9½	—		—	760× 90	760× 90
	*12-14 Vinot (4)........ ,,	12.1	70×110	1689	—	£335	4	17 0	3	Bevel	Mag.	9 0	4 0	—	—	9½	—		—	760× 90	760× 90
	*15-20 Vinot (4)........ ,,	15.8	80×130	2610	£330	£445	5	14 0	3	Bevel	Mag.	9 9½	4 2	—	—	9½	8 1½ ×	—	—	815×105	815×105
	*25-30 Vinot (4)........ ,,	25.2	101×130	4165	£460	£600	5	18 0	3	Bevel	Mag.	10 2	4 4	—	—	9½	—		—	820×120	820×120

*Straker-Squire Colonial model with special gear ratios, springs, radiator, petrol tank, and road wheels, road clearance 9¼in., chassis price, with tyres, £343. *18 h.p. Thornycroft £30 extra for wire wheels. *Both Valveless models have two-stroke engines. *Vinot prices include Captain rims; weights of 12-14 h.p. model are for complete car.

The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheelbase.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space Length	Body Space Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
V (cont.)	Vivinus (4) .... Belgium	13.9	75×110	1940	£275	£325	4	15 0	3	Bevel	Mag.	9 6	4 3	—	—	9	—		—	810× 90	810× 90
	Vivinus (4) .... "	20.1	90×110	2798	£325	£375	4	16 0	3	Bevel	Mag.	9 6	4 5	—	—	9¾	—		—	815×105	815×105
	Vivinus (4) .... "	27.8	106×120	4224	£425	£500	4	18 0	3	Bevel	Mag.	10 0	4 5	—	—	9¾	—		—	815×105	815×105
	*10-15 Vulcan (4) ...... England	15.8	80×120	2409	£240	£295	4	13 0	3	Worm	Mag.	8 9	4 1	5 0	12 5	8½	7 1	× —	6 6	760× 90	760× 90
	*15.9 Vulcan (4) .... "	15.8	80×120	2409	£285	£350	5	14 0	4	Worm	Mag.	8 10	4 8	5 5	12 7	8½	7 6	× —	6 8	810× 90	810× 90
	*15-20 Vulcan (4) ...... "	15.8	80×150	3012	£325	£400	5	15 2	4	Worm	Mag.	10 2	4 8	5 5	13 4	8½	8 0	× —	7 2	815×105	815×105
	*25-30 Vulcan (6) ...... "	29.4	89×120	4476	£425	£505	5	17 1	4	Worm	Dual	10 3	4 8	5 8	14 9	8½	8 2	× —	7 3	875×105	875×105
W	Waverley (4) ...... England	10.5	65×130	1728	£210	£225	2 or 3	10 0	3	Bevel	Mag.	9 2	4 2	4 9½	12 0	9½	6 3	×3 0	5 8	750× 85	750× 85
	Waverley (4) ...... "	13.9	75×120	2116	—	—	4	10 2	3	Bevel	Mag.	9 2	4 2	4 9½	12 0	9½	6 3	×3 0	5 8	750× 85	750× 85
	*20-30 White (4) .... U.S.A.	22.4	95×130	3680	£465	£595	5	16 2	4	Bevel	Mag.	10 0	4 8	5 8	13 1	10	8 0	×2 8	6 8	880×120	880×120
	*48.6 Winton (6) .... U.S.A.	48.3	114×127	7776	—	£650	5	30 0	4	Bevel	Dual	10 10	4 8½	5 9	14 11	9¾	9 4⅜	×2 10⅛	7 1⅞	910×114	910×114
	20 Withers (4) .... England	20.1	90×130	3307	£430	—	—	—	4	Bevel	Mag.	9 6	4 7	—	—		8 2	×2 9½	6 9	820×120	820×120
	25 Withers (4) .... "	24.8	100×130	4082	£500	—	—	—	4	Bevel	Mag.	10 3	4 7	—	—		8 2	×2 9½	7 0	880×120	880×120
	30 Withers (4) .... "	30.0	110×130	4940	£560	—	—	—	4	Bevel	Mag.	10 8	4 7	—	—		8 6	×2 9½	7 3¼	880×120	880×120
	35-40 Withers (4) ...... "	35.7	120×130	5876	£600	—	—	—	4	Bevel	Mag.	10 8	4 7	—	—		8 6	×2 9½	7 3¼	895×135	895×135
	*16-20 Wolseley (4) .... England	20.1	90×121	3080	—	£460	—	17 2	4	Worm	Mag.	10 3	4 5	5 7	13 10	6½	8 8	×2 8	7 5	815×105	815×105
	*16-20 Wolseley (4) (long) (lan'l)	20.1	90×121	3080	—	£600	—	18 2	4	Worm	Mag.	10 9	4 5	5 7	14 4	6½	9 2	×2 8	7 11	820×120	820×120
	*24-30 Wolseley (6)	30.2	90×130	4961	—	£675		22 0	4	Bevel	Dual	10 11	4 7	5 10	15 2	7½	8 11	×2 10	7 6	895×135	895×135
	*24-30 Wolseley (6) (long) (lan'l)	30.2	90×130	4961	—	£800	—	23 0	4	Bevel	Dual	11 5	4 7	5 10	15 8	7½	9 5	×2 10	8 0	895×135	895×135
	*50 Wolseley (6)	48.3	114×146	8928	—	£1100	—	29 0	3	Bevel	Dual	11 9	4 8	5 11	15 11	8	9 0	×2 10	7 7	935×135	935×135
	*50 Wolseley (6) (long) (lan'l)	48.3	114×146	8928	—	£1225	—	30 0	3	Bevel	Dual	12 3	4 8	5 11	16 5	8	9 6	×2 10	8 1	935×135	935×135
Z	8 Zebra (4) .... France	6.2	50×100	784	—	£165	2	8 0	3	—	—	7 0	3 8	4 2	10 0	8	—		—	700× 80	700× 80
	10-12 Zebra (4) .... "	11.3	68×120	1744	—	£255	4	12 0	3	—	—	8 0	3 7	4 6	13 0	8	—		—	750× 85	750× 85
	14-20 Zedel (4) .... "	12.8	72×120	1953	£290	—	—	13 2	4	Bevel	Mag.	8 2	3 9½	—	—	10	7 2½	×2 6	6 10	760× 90	760× 90
	25-30 Zedel (4) .... "	20.1	90×140	3561	£475	—	—	16 2	4	Bevel	Mag.	10 0	4 3	—	—	11	8 5	×2 9½	7 3½	820×120	820×120

*10-15 h.p. Vulcan car price includes hood, screen, head lamps, side and tail lamps, and horn; other Vulcan models, complete prices include fifth detachable wood wheel as well; the 15-20 h.p. Vulcan is also made with a shorter wheelbase. *The Winton price is f.o.b. Cleveland, U.S.A. *Wolseley open car prices include hood and screen; compressed air starter also included, except on the 16-20 h.p. model. *White chassis price includes electric starting and lighting outfit, and fifth Warland dual rim and tyre; complete price includes hood, screen, five lamps, and speedometer as well.

Steam Cars.

H.P., Name of Car, Number of Cylinders, and Country of Origin.	Bore and Stroke.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weight of Chassis.	No. of Gears	Final Drive.	Wheelbase.	Track	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
	mm.				ct. qr.			ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm
Pearson-Cox (3) .... England	61× 77	£330	£380	4	14 0	1	Bevel	9 0	4 2	5 2	12 2	7½	7 9	×2 8	6 6	810× 90	810× 90
Pearson-Cox (3) .... "	61× 77	£330	£362	2	14 0	1	Bevel	9 0	4 2	5 2	12 2	7½	7 9	×2 8	6 6	810× 90	810× 90
Pearson-Cox (3) (Colonial) "	61× 77	£356	£406	4	14 0	2	Bevel	9 0	4 2	5 2	12 2	9	7 9	×2 8	6 6	810× 99	810× 90
10 Stanley (2) d'ble acting U.S.A.	83×108	£230	£295	3	14 0	1	Spur	8 8	4 6	5 8	11 2	9	6 8	×2 11	6 4	810× 90	810× 90
20 Stanley (2) " "	101×127	£340	£385	2	18 0	1	Spur	9 7	4 6	5 8	12 0	10	7 6	×2 11	7 1	815×105	815×105
30 Stanley (2) " "	127×152	£475	£550	5	22 0	1	Spur	11 2	4 6	5 8	—	10½	—		—	920×120	920×120

The Autocars of 1913.—

H.P., Name of Car, Number of Cylinders, and Country of Origin.	Bore and Stroke.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weight of Chassis.	No. of Gears	Final Drive.	Wheel-base.	Track	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
	inches.				ct. qr.			ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
10 Turner-Miesse (3) ......England	1 5/16" × 3⅛"	£280	£295	2	15 0	—	Bevel	8 0	4 3½	5 6	11 6	9	6 3	×2 8	—	810 × 90	810 × 90
12 Turner-Miesse (3) ...... ,,	2" × 3⅛"	£320	£350	4 or 5	17 2	—	Bevel	9 0	4 3½	5 6	12 6	9	7 3	×2 8	—	810 × 100	810 × 100
15 Turner-Miesse (3) ...... ,,	2 1/16" × 3⅛"	£400	£450	4 or 5	19 0	—	Bevel	9 0	4 3½	5 6	12 6	9	7 3	×2 8	—	815 × 105	815 × 105
20 Turner-Miesse (3) ...... ,,	2 5/16" × 3½"	£570	£650	4 or 5	21 0	—	Bevel	9 6	4 3½	6 0	13 0	9	7 9	×3 0	—	820 × 120	820 × 120

Miniature Cars, Runabouts, and Tricars.

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price. Chassis with tyres.	Price. Car Complete.	No. of Seats.	Weig't of Chassis.	No. of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length	Body Space. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm.	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	in.	ft. in.	ft. in.	ft. in.	mm.	mm.
A	A.C. (1) ....England	5.6	95 × 102	723	—	£93	2 or 3	5 0	2	Chain	Mag.	6 2	4 6	5 3	9 1	5½	—		7 9	650 × 65	650 × 65
	Arden (2) ....England	8.9	85 × 85	964	£104	£116	2	5 2	3	Bevel	Mag.	7 0	3 8	4 4	9 6	8	7 6	×2 5	5 8	700 × 65	700 × 65
	Arden (2) (special) .. ,,	8.9	85 × 85	964	£108	£121	2	5 1	3	Worm	Mag.	7 0	3 8	4 4	9 6	9	7 6	×2 5	5 8	700 × 65	700 × 65
	8 Ariel (2) ....England	8.9	85 × 85	964	—	—	2	5 0	2	Chain	Mag.	7 6	4 0	4 10	10 0	8	6 2	×3 3	5 3	650 × 65	650 × 65
	Autocrat (2) (V type) England	8.9	85 × 85	964	£80	£100	2	6 0	3	Chain	Mag.	7 6	3 9	4 9	9 8	9	6 0	×2 9	5 2	650 × 65	650 × 65
	Autocrat (2) (vertical) ,,	8.9	85 × 85	964	£90	£110	2	6 2	3	Chain	Mag.	7 6	3 9	4 9	9 8	9	6 0	×2 10	5 2	650 × 65	650 × 65
	8-10 Averies (4) ......France	8.9	60 × 100	1100	—	£158	2	6 0	3	Worm	Mag.	7 3	3 9	4 9	10 0	8	5 8½	×3 1½	4 9½	650 × 65	650 × 65
B	3½ Bedelia (1) ....France	3.4	75 × 84	371	—	£59	2	3 2	2	Belt	M. or A.	8 6	3 6	3 6	10 10	6	—		—	650 × 55	650 × 55
	4½ Bedelia (1) .... ,,	4.2	82 × 89	470	—	£70	2	3 2	2	Belt	M. or A.	8 6	3 6	3 6	10 10	6	—		—	650 × 55	650 × 55
	5½ Bedelia (1) .... ,,	3.9	80 × 100	503	—	£84	2	3 2	2	Belt	Mag.	8 6	3 6	3 6	10 10	6	—		—	650 × 55	650 × 55
	8-10 Bedelia (2) ...... ,,	7.9	80 × 100	1006	—	£101	2	3 3	2	Belt	Acc.	8 6	3 6	3 6	10 10	6	—		—	650 × 60	650 × 60
	8-10 Bedelia (2) ...... ,,	7.9	80 × 100	1006	—	£109	2	3 3	2	Belt	Mag.	8 6	3 6	3 6	10 10	6	—		—	650 × 60	650 × 60
C	* 5-6 C. & H. (2) ......England	6.1	70 × 80	616	—	£100	2	3 3	3	Chain	Mag.	6 6	4 3	4 9	9 2	9	5 6	×2 6	4 4	650 × 65	700 × 75
	* 8 C. & H. (2)......... ,,	8.9	85 × 85	964	—	£105	2	4 0	3	Chain	Mag.	6 6	4 3	4 9	9 2	9	5 6	×2 6	4 4	650 × 65	700 × 75
	5-6 C. & H. (2) ...... ,,	6.1	70 × 80	616	—	£110	2	4 0	3	Chain	Mag.	6 6	4 0	4 6	8 9	9	5 0	×2 6	4 4	650 × 65	650 × 65
	8 C. & H. (2) .... ,,	8.9	85 × 85	964	—	£115	2	4 1	3	Chain	Mag.	6 6	4 0	4 6	8 9	9	5 0	×2 6	4 4	650 × 65	650 × 65
	Chater-Lea (2) .....England	8.9	85 × 85	964	£100	—	2	—	3	Worm	Mag.	7 6	3 10	—	—	—	—		—	650 × 65	650 × 65
	Chota (1) ....England	4.91	89 × 120	746	—	—	2	4 0	—	Belt	Mag.	6 4	—	—	—	—	—		—	650 × 65	650 × 65
	8 Crescent (2) ....England	8.9	85 × 85	964	—	£100	2	5 0	Fric.	Chain	Mag.	7 9	3 2	3 9	10 3	9	—		—	650 × 65	650 × 65
	Crouch Carette (2) .England	7.9	80 × 90	905	£118	£128	2	6 0	3	Chain	Mag.	7 3	4 6	5 0	9 6	7	5 0	×3 10	—	650 × 65	650 × 65
D	Duo (2) ....England	8.9	85 × 85	964	—	£100	2	4 0	—	Belt	Mag.	7 3	3 4½	4 2	9 9	9	—		5 0	26" × 2½"	26" × 2½"
E	* 8-10 Eagle (2)........England	8.9	85 × 88	998	£109	£131	2	4 2	3	Worm	Mag.	7 0	4 0	4 8	10 0	8	6 10	×2 6	5 6	650 × 65	650 × 65
	* 8-10 Eagle (2)........ ,,	8.9	85 × 88	998	£119	£141	2	5 0	3	Worm	Mag.	7 0	4 0	4 8	10 0	8	6 10	×2 6	5 6	650 × 65	650 × 65
F	8-10 Flycar (2) ......England	8.9	85 × 96	1090	£105	£115	2	5 0	3	Belt	Dual	7 6	3 9	4 6	10 0	12	5 3	×2 9	4 9	650 × 65	650 × 65
G	Gillyard (2) ......England	8.9	85 × 85	964	£90	£100	2	4 2	3	Chain	Mag.	6 10	3 10	5 3	10 0	8	2 0	×3 6	4 6	650 × 65	650 × 65
	* 8 Globe (1) ....England	6.84	105 × 120	1037	—	£152	2	6 0	2	Chain	Mag.	7 3	3 4	—	—	5	—		—	700 × 75	700 × 75
	4½ Glover (1) ....England	4.91	89 × 96	597	—	£79	2	3 0	2	Belt	Mag.	7 0	4 0	4 6	9 4	4	6 0	×3 0	5 6	650 × 65	650 × 65

*All C. & H. models are water-cooled; the £100 and £105 models are three-wheeled. *The Eagle is made water or air-cooled. *Globe price includes hood and screen, three lamps, generator pump, horn, and speedometer.

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The Autocars of 1913.—

	H.P., Name of Car, Number of Cylinders, and Country of Origin.	H.P. by R.A.C. Rating	Bore and Stroke.	Engine Capacity.	Price — Chassis with tyres.	Price — Car Complete.	No. of Seats.	Weig't of Chassis.	No of Gears	Final Drive.	Ignition	Wheel-base.	Track.	Extreme Width.	Extreme Length	Road Clearance.	Body Space. Length. Width	Dash to Back Wheel Centre	Tyres. Front.	Tyres. Back.
			mm	c.c.				ct. qr.				ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in. ft. in.	ft. in.	mm.	mm.
G	G.N. (2) .... England	7.9	80 × 98	986	£91	£100	2	3 3	2	Belt	Mag.	8 0	3 6	4 2	11 0	9	6 0 × 2 0	5 4	650 × 65	650 × 65
	8 Gordon (2) .... England	8.9	85 × 95	1078	—	£135	2	4 0	3	Chain	M. Acc.	7 6	3 8	4 6	9 6	7½	5 8 × 2 4	5 0	26" × 2½"	26" × 2½"
(cont.)	10 Gordon (2) .... England	8.9	85 × 120	1360	-	£160	4	5 0	3	Chain	M. Acc.	8 4	3 8	4 6	10 4	7½	6 6 × 2 4	5 10	700 × 85	700 × 85
	8 C.W.K. (2) .... England	9.2	86 × 92	1068	-	£135	2	6 0	4	Bevel	Mag.	7 7	3 9	4 6	10 0	9	4 10 × 2 10½	—	650 × 65	650 × 65
H	6½ H.P. (1) .... France	3.95	80 × 140	704	–	£125	2	7 0	—	Chain	Mag.	6 3	3 6	4 2	8 6	6	—	—	650 × 65	650 × 65
	* Humberette (2) ... England	8.7	84 × 90	998		£125	2	—	3	Bevel	Mag.	7 3	3 6	4 4	10 0	9	5 7 × —	—	650 × 65	650 × 65
K	Kendall (2) ...... England	7.9	80 × 94	944	£83	£90	2	4 2	2	Belt	Mag.	6 3	4 0	5 0	7 6	9	3 0 × 3 0	3 8	650 × 65	650 × 65
	Kendall (2) ...... ,,	8.7	84 × 94	1040	£105	£115	2	5 2	2	Worm	Mag.	7 0	4 2	5 2	8 0	9	—	—	650 × 65	650 × 65
L	8 Lambert (2) .... England	8.9	85 × 85	964	–	£104	2	4 0	3	Chain	Mag.	6 0	3 9	4 3	8 6	—	3 6 × 2 4	—	650 × 65	650 × 65
	L.E.C. (2) .... England	7.9	80 × 108	1084	--	£145	2	6 0	3	Bevel	Mag.	7 10	3 9	4 3	10 4	8	6 8 × 2 5	5 10	700 × 75	700 × 75
	8 L.M. (2) .... England	8.9	85 × 85	964	–	£100	2	4 0	2	Chain	Mag.	7 9	3 3	3 8	10 3	7½	6 6 × 2 4	5 8	650 × 65	650 × 65
M	8-10 Marlborough (4) . France	8.4	59 × 100	1092	£160	£185	2	6 0	3	Bevel	Mag.	9 0	3 10	5 0	12 0	10	—	—	700 × 65	700 × 65
	8 Morgan (2) .... England	8.9	85 × 85	964	£86	£90	2	2 2	2	Chain	Mag.	6 0	4 0	4 7	8 6	7½	—	5 0	—	—
	*10 Morris-Oxford (4) . England	8.9	60 × 90	1016	—	£175	2	—	3	Worm	Mag.	7 0	3 4	3 9	10 5	—	—	—	700 × 80	700 × 80
P	8 P.D.A. (2) .... England	8.9	85 × 85	964	—	£113	2	3 2	2	Bevel	Mag.	6 10	3 8	4 0	9 6	8	4 4½ × 2 5	4 0	650 × 65	650 × 65
	9 Premier (2) .... England	8.9	85 × 88	998	—	£105	2	—	2	Chain	Mag.	6 0	4 0	5 0	8 8	9	—	—	26" × 2½"	26" × 2½"
R	8 Rollo (2) (tandem) . England	8.9	85 × 85	964	—	£100	2	4 2	Var.	Belt	Mag.	8 3	3 8	4 0	—	6	5 4 × 2 0	5 9	26" × 2½"	26" × 2½"
	8 Rollo (2) (sociable) . ,,	8.9	85 × 85	964	—	£100	2	4 3	Var.	Belt	Mag.	8 3	4 0	4 6	—	6	5 4 × 2 5	5 9	26" × 2½"	26" × 2½"
S	8 Sabella (2) (tandem) England	8.9	85 × 85	964	—	£96	2	4 0	Var.	Belt	Mag.	8 3	3 2	4 0	11 5	8	—	—	26" × 2½"	26" × 2½"
	10 Sabella (2) .... ,,	8.9	85 × 95	1078	—	—	2 or 3	4 2	Var.	Belt	Mag.	8 3	3 4	4 4	11 3	8	5 9 × 2 3	5 11	26" × 2½"	26" × 2½"
	Super (2) .... France	8.9	85 × 85	964	—	£100	2	3 2	7	B & C	Mag.	9 0	3 3	3 6	10 6	10	4 0 × 2 9	8 0	650 × 65	650 × 65
	Super (2) .... ,,	6.4	72 × 120	976	--	£100	2	3 2	7	B & C	Mag.	9 0	3 3	3 6	10 6	10	4 0 × 2 9	8 0	650 × 65	650 × 65
	7 Swift (2) .... England	6.9	75 × 110	972	—	—	—	—	3	Shaft	Mag.	7 0	3 4	—	—	—	—	—	600 × 65	650 × 65
T	8 Tiny (2) .... England	8.9	85 × 85	964	£87	£103	2	4 0	3	Chain	Mag.	8 6	3 8	4 3	11 0	12	4 3 × 4 0	6 6	650 × 65	650 × 65
	8 Tyseley (2) .... England	8.5	83 × 102	1088	—	£150	2	5 3	2	Bevel	Mag.	7 0	4 0	4 8	9 10	8½	5 10½ × 2 7	5 0	650 × 65	650 × 65
W	8-10 Walcycar (2) .... England	8.9	85 × 85	964	–	£100	2	4 2	2	Bevel	Mag.	6 9	3 2	4 8	8 11	9	4 0 × 3 6	3 6	650 × 65	650 × 65
	4½ Wall (1) .... England	4.91	89 × 96	597	--	£95	2	3 0	2	Bevel	Mag.	6 3	3 8	4 2	8 6	6	2 6 × 2 1	2 6	650 × 65	650 × 65
	6 Wall (2) .... ,,	6.9	75 × 80	706	—	£102	2	3 0	2	Bevel	Mag.	6 3	3 8	4 2	8 6	6	2 6 × 2 1	2 6	650 × 65	650 × 65
	* Warne (2) .... England	8.9	85 × 85	964	—	£99	2	4 3	2	Belt	Mag.	8 0	3 6	4 5	10 2	9	-	—	26" × 2½"	26" × 2½"
	* 4 Whippet (1) .... England	4.4	85 × 85	482	—	£60	1	2 2	2	Belt	Bat.	6 6	3 0	3 6	8 0	12	—	5 4	650 × 55	650 × 55
	* 6 Whippet (2) .... ,,	6.1	70 × 80	616	—	£90	2	3 2	2	Belt	Mag.	6 6	3 10	4 2	8 0	12	—	5 4	650 × 65	650 × 65
Z	Zebra (1)	4.5	88 × 106	644	—	£145	2	7 0	3	Bevel	Mag.	6 0	3 8	4 2	8 6	8	—	—	700 × 75	700 × 75

*Humberette price includes hood, screen, and three lamps complete vehicle. *Whippet weights are for complete car. *Morris-Oxford price includes hood, screen, five lamps, generator, five Sankey wheels. For Salmon, Singer, and Peugeot light cars, see car section. *Warne weight is for

Freight Charges and Duties on Motor Cars Shipped Abroad.

THE freight charges include cost of cartage in London within four miles of the Bank, packing, dock dues, shipping, and freight per 40 cubic feet (unless otherwise stated). When the weight of the car or chassis packed exceeds 30 cwt., the charge is more. Figures given are for one car or chassis only.

For the compilation of the following tables we are indebted to an old established firm of carriers and shippers, Messrs. Davies, Turner, and Co., Ltd., of 52, Lime Street, London, E.C., and elsewhere.

Name of Country to which the Rates and Duties apply.	Cost of Cartage in London within 4 mls of the Bank, packing in Case, Dock Dues, Shipping & Freight per 40 cubic ft. (unless otherwise stated) £ s. d.	These Duties are compiled from Official Sources, but without Responsibility. % = per centum *ad valorem*.
ANTIGUA		
St. John's	3 3 0	13½%
ARGENTINE REPUBLIC		
Buenos Ayres	2 17 0	12%*
AUSTRALIA		
Adelaide	2 18 0	Bodies, including dashboards, footboards, and mudguards, if British manufacture: single-seated, £15; double seated, £21; with fixed or movable canopy tops, *e.g.*, landaulette, limousine, taxicab, or similar types, and n.e.i. £36; chassis (British), free; chassis (if of foreign manufacture), 5%. pneumatic tyres (including covers and tubes), 1s. 2d. per lb., or 20%.
Brisbane	2 15 6	
Melbourne	2 18 0	
Sydney	2 18 0	
Fremantle	3 2 9	
Hobart	3 2 9	
Launceston	3 2 9	
AUSTRIA-HUNGARY		
Trieste	1 18 6	Over 400 kilos. and up to 1,800 kilos. per cwt. £3 10 10; 1,800 ,, 3,200 ,, £2 2 4; 3,200 ,, £1 5 5
BAHAMAS		
Nassau	4 4 0	10%
BARBADOES		
Bridgetown	2 16 0	10%
BELGIUM		
Antwerp	5 14 3 20 cwt.	12%
Ostend	6 0 0 ,,	
Brussels	10 3 0 car	
BERMUDA		
Hamilton	2 6 0	10%
BRAZIL		
Bahia	4 3 3	7%*
Rio de Janeiro	3 12 3	
Santos	3 4 9	
BULGARIA		
Sofia	4 5 9	£10 each.
CANADA		
Halifax, N.S.	2 7 0	Under British pref. tariff, 22½%; ,, intermediate tariff, 30%; ,, general tariff, 35%
Montreal	2 10 0	
Quebec	2 12 9	
St. John's, N.B.	2 7 0	
Vancouver, B.C.	18 1 0 20 cwt.	
Victoria, B.C.	18 1 0 ,,	
CEYLON		
Colombo	2 0 9	5½%
CHINA		
Hong-Kong	2 15 6	Free
Shanghai	2 18 0	5%
CYPRUS		
Larnaca	2 15 0	10%
DENMARK		
Copenhagen	1 9 9	5s. 7¾d. per cwt.
DOMINICA		
Roseau	3 4 9	12½%
EGYPT		
Alexandria	2 4 6	8%
Port Said	1 15 0	
FIJI		
Suva	3 17 0	12½%
FINLAND (summer season)		"Carriages with wheels with springs" Wholly covered, £12; half covered, £6; not covered (open), £2 8s.
Helsingfors	1 16 6	
Hango	1 16 6	
FRANCE		
Bordeaux	13 3 0 car	From 500 to 2,500 kilos. (exclusive), £1 10s. 6d. per cwt.; 2,500 kilos. or more, £1 0s. 4d. per cwt.
Boulogne	5 5 0 20 cwt.	
Marseilles (per 40 ft.)	1 16 6	
Paris	8 5 0 20 cwt.	
GERMANY		Over 500 and up to 1,000 kilos., 12s. 6d. per cwt.; over 1,000 kilos., 7s. 6d. per cwt.
Bremen	11 7 0 car	
Hamburg	6 9 0 20 cwt.	
GOLD COAST		
Accra and Cape Coast	3 12 6	Free
GREECE		
Piræus	2 3 3	From £20 to £130 per car, according to the h.p. and number of cylinders (particulars on application).
GRENADA	3 1 6	10% plus 10% of the amount of duty leviable at the rate given.
GUATEMALA		
San Jose	3 11 0	*
GUIANA (British)		12½% plus 5% of the amount of duty leviable at the rate given.
Demerara	2 15 6	
HAWAII		
Honolulu	18 11 9 20 cwt	45%*
HAYTI	4 17 3	On application*
HOLLAND		
Amsterdam	6 8 6 20 cwt	5%
Rotterdam	6 9 6 ,,	
HONDURAS (British)		
Belize	3 11 0	12½%
ITALY		
Genoa	9 5 6 20 cwt.	Over 500 kilos. and up to 1,000 kilos., £16 each; more than 1,000 kilos., £24 each
Leghorn	9 5 6 ,,	
Naples	10 5 6 ,,	
INDIA		
Bombay and Calcutta	1 15 6	5%
Karachi	1 15 6	
Madras	2 0 3	
JAMAICA		
Kingston	2 15 6	16⅔%
JAPAN		50% according to the general tariff; 35% according to the conventional tariff, which necessitates a certificate of origin
Kobe	2 18 0	
Yokohama	2 18 0	
LIBERIA		
Monrovia	4 4 0	12½%*
MAURITIUS		
Port Louis	2 14 3	12%
MEXICO		
Vera Cruz	2 19 9	More than 750 kilos.: For the first 250 kilos., £3 8s. 6d. per cwt.; for the 500 following kilos, £2 17s. 1d. per cwt. for the weight in excess of 750 kilos., £2 6s. 8d. per cwt.*
MONACO		
Nice (for Monte Carlo)	2 8 6	Same as France
MONTSERRAT		
Plymouth	3 6 0	13½%
MOROCCO		
Tangier	2 2 6	12½%
NEVIS		
Charlestown	3 6 0	11%
NEWFOUNDLAND		
St. John's	2 4 0	30%
NEW ZEALAND		
Auckland	3 2 3	Motor car bodies and mudguards, 20%; chassis for motor cars (whether attached or unattached, including wheels, speed gears, and radiators, free
Wellington	3 2 3	
Dunedin	3 4 9	
Lyttleton	3 4 9	
NICARAGUA		
Corinto	3 11 0	$15 (gold) per 100 kilos *
NIGERIA		
Lagos	3 7 6	Free
NORWAY		
Christiania	1 9 9	12%
PERU		
Callao	3 15 3	5%*
PORTUGAL		
Lisbon	1 15 9	£27 each *
ROUMANIA		
Bucharest	2 19 6	From 500 to 1,000 kilos., 18s. 3d. per cwt.; 1,000 kilos. or more, 12s. 2½d. per cwt
RUSSIA		
St. Petersburg	1 9 9	Cars with 4 places or more, £23 4s. 5d. each; with less than 4 places, £14 15s. 7d
ST. LUCIA	3 3 9	15%
ST. VINCENT	3 3 9	10% plus 10% of the amount of duty leviable at the rate given
SIAM		
Bangkok	2 15 6	3%
SIERRA LEONE	3 7 6	10%
SOUTH AFRICA		
Capetown	3 0 0	Under British pref. tariff, 12%; ,, general tariff, 15%
Delagoa Bay	3 10 0	
Durban (Natal)	3 7 6	
East London	3 6 3	
Port Elizabeth	3 0 0	
SPAIN		
Barcelona	1 19 0	Not more than 1,000 kilos., £1 12s. 6d. per cwt.; more than 1,000 kilos., £2 0s. 8d. per cwt. plus £8 if open carriage, or £12 16s. if closed carriage.*
Bilbao	1 19 0	
Gyjon	1 19 0	
Santander	1 19 0	
STRAITS SETTLEM'TS		
Penang and Singapore	2 10 9	Free
SWEDEN		
Stockholm	2 0 0	15%
Gothenburg	1 12 6	
SWITZERLAND		
Basle	13 3 0 car	16s. 3d. per cwt.
TOBAGO	3 1 6	Motor cars for pleasure to seat 2 (including driver), £10 each; for each additional seat, £2 10s.
TRINIDAD		
Port of Spain	2 16 0	Motor cars for pleasure to seat 2 (including driver), £10 each; for each additional seat, £2 10s.
TURKEY		
Constantinople	2 3 3	11%
U.S.A.		
Boston	2 4 0	45% *
New York	2 5 0	
Philadelphia	2 1 0	
VIRGIN ISLANDS (Dan.)		
St. Thomas	3 11 9	10%

* Consulage charges extra. The above rates are liable at any time to alteration without notice. *November 1st 1912.*

Brooklands.

A History and Description of the Famous Racing Track.

ALTHOUGH Brooklands is so popular, there are numbers of motorists at home quite apart from those abroad who have never seen Brooklands. This fact was quite forcibly brought home to me once when I drove down with a certain diplomatist, a man who is a keen motorist and widely travelled, a man who knows the capitals of Europe about as well as most of us know the way from Hyde Park Corner to Piccadilly Circus, and yet he had never seen Brooklands. We drove in at the top gate, where one gets just a glimpse of the far end of the track, and then we ran round those wonderful cuttings in the hillside where the back of the colossal banking of the track towers on one's left and the tunnels for foot passengers run under the roadway and under the track itself from the right. After a series of corkscrew turns and blind corners, one plunges down a hill through a tunnel under the track, and comes out suddenly in the arena of the vast amphitheatre.

The whole panorama strikes one suddenly, and I can quite imagine that at first sight it is even a trifle overwhelming. Right in front is the paddock, with the clubhouse, car sheds, offices, and so forth. Beyond, and extending the whole way round to the right is the immense flat plain of the flying ground bounded by the motor track, which shuts out all other views, and forms the horizon, so that one feels as one imagines a fly might feel if he found himself set down on a green silk table-centre with a white border. Behind is the banking of the track, and to the left is the finishing straight with the grandstand hill beyond.

Far away across the plain, as it were in the opposite corner of the table-centre, are some curious-looking buildings. These are the "hangars" of which the regular Brooklands people are so proud, for are they not the first real aero settlement in England?

If one is lucky, one may, on emerging from the tunnel, see a number of large white flies running about on the tablecloth, and perhaps some in the air, for so huge is the plain that an aeroplane thirty to forty feet across only looks like a fly at the distance of one end of the plain from the other.

However, although there were no aeroplanes about, the sheer immensity of the place fairly took my diplomatist's breath away. "Phw-e-w," he whistled, "what a place! Think of the work this meant! Why, it is one of the seven wonders of the world!"

It is so long since I went to school that I have forgotten what were the original seven wonders of the world. The Colossus of Rhodes was one, the Pyramids were another, and then there were the Hanging-Gardens of Babylon, and some others. The modern seven wonders include, I believe, the Forth Bridge and the Assouan Dam, but I am certain that the Brooklands Motor Track and Aviation Ground should be numbered among them.

I suppose there are those who would compare the removal of trees and farms from the meadows by the Wey in order to build the place, with the laying waste of Southern Hampshire in order to make the New Forest for William's hunting parties, but as a matter of fact I believe the occupants of the farms that used to be at Brooklands are now all very busy on jobs appertaining to the track.

As I remember the place first it was a series of somewhat swampy meadows lying alongside a very winding, sluggish stream, with pretty pine-clad hills on one side and an ugly railway bank on the other. Now it is as it has become familiar in the pictures.

The second time I saw it was on that weird and wonderful night on which Mr. S. F. Edge tore round and round, doing his steady 65 to 70 miles an hour on his Napier by the glare of Wells flares, what time four attendant demons, two in white and two in red, chased him alternately on two other Napier cars, and yet, in spite of resting and driving in turn, never caught him. That was in 1907, and his record still stands, and he and his mechanic remain the only two men in the world who have ever travelled for twenty-four hours on end at a speed of over a mile a minute. Do not let us forget this fact, for only at Brooklands was such a feat possible, and if Brooklands had not been built it might still be impossible. Probably the next time the feat will be accomplished it will be in an aeroplane, and if it should be done by a Britisher then Brooklands will again claim its share of credit, as being the birthplace of British aviation.

The man to whom the initiation of so vast an enterprise is due is Mr. H. F. Locke-King, and some day, when we have a motoring Ministry in power with an aeroplaning Premier, Mr. Locke-King will be raised to some high dignity, or, perhaps, as the event is probably a long way ahead, he will be canonised.

Mr. Locke-King was inspired with the idea of a monumental motordrome when watching a race for the Targa Florio round the Brescia Circuit, in Italy. French, German, and Italian cars were competing, but not a solitary English car or man. It is true that a year or so later the Wolseley Company sent over three Wolseley cars for the Targa Florio which performed well, but met with accidents.

However, when Mr. Locke-King was there he did not see even a single British car, so he bethought himself of the need for a place where British cars could be tuned up for international races, and where cars of all kinds could race without being "defended to circulate," as the French put it.

Now Mr. Locke-King owned Brooklands, and he still owns it, so, as Lord Montagu put it at the time of the first meeting in July, 1907, "he not only built the course, but personally superintended the works for eight months, and watched the great motordrome grow out of sand and gravel." Mr. Locke-King called in Colonel Holden, a Royal Engineer, who pointed out that, instead of a mere roadway round the property, it would be necessary to have banks thirty feet high if the high-speed cars were to get round safely at their best pace.

This imported all kinds of fresh troubles, but the dauntless proprietor decided to tackle them, and Mr. Donaldson, a clever railway engineer, was brought in to tackle the difficulties. To get above flood-water mark, the finishing straight, threequarters of a mile in length, had to be raised over five feet, and something over an acre of land for the paddock and car sheds had to be brought to the same level. Then a mile of the track at the south end had to be raised and banked to a height of nearly twenty feet, and a cutting thirty feet deep and nearly forty yards wide had to be made in the back of the hill on which the stands now are. The "dump" from this cutting, which is nearly a quarter of a mile long, was carried round and built into a huge banking over fifty feet

A Bird's-eye View of Brooklands.

A complete lap—not including the finishing straight—measured to the inner edge of the track is $2\frac{11}{16}$ miles. A full lap, with the finishing straight added, is $3\frac{1}{4}$ miles. The flying village is discernible in the right top hand corner. (See descriptive history of the track on pages 39 and 41.)

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810 × 90	6 - 0 - 0	6 - 17 - 0	1 - 8 - 6	164·00	193·00	38·00	810 × 90
765 × 105	7 - 3 - 6	8 - 6 - 6	1 - 12 - 0	202·00	235·00	43·00	765 × 105
815 × 105	8 - 0 - 6	9 - 3 - 6	1 - 14 - 0	215·00	255·00	45·00	815 × 105
820 × 120	11 - 0 - 0	12 - 9 - 6	2 - 0 - 0	294·00	340·00	50·00	820 × 120
880 × 120	11 - 14 - 6	13 - 10 - 0	2 - 3 - 0	315·00	370·00	54·00	880 × 120
885 × 135	14 - 3 - 6	16 - 1 - 0	2 - 8 - 6	396·00	453·00	65·00	895 × 135
935 × 135	14 - 19 - 6	16 - 17 - 6	2 - 12 - 0	418·00	476·00	69·00	935 × 135

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See pages vi. and vii. for further particulars.

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high and seven hundred yards long. The banking had to cross the river, therefore to enable it to do so a ferro-concrete tunnel had to be built to let the river through, and on top of this the banking was built up.

From March, 1907, to June of the same year the surfacing of the track with concrete was going on, and two hundred thousand tons (Think of it! 200,000 tons) of material were used in the process. Eighty truck loads of material were delivered every day, and this was handled by six locomotives over seven miles of railway inside the track. Two thousand men were constantly at work, day and night, and there were ten steam grabs and a steam navvy doing the digging. There were also two hundred carpenters, sawyers, and woodmen felling timber, and building up benches, stands, and fencing.

For one reason or another Brooklands did not "catch on" at first, and for some years it, in theatrical parlance, "failed to attract." The committee were certainly at a disadvantage, for they had no precedent to go by, and had to learn from their own mistakes. At the first few meetings the "press" considered that they were slighted, and certainly journalists were not treated with the affability to which they had been accustomed by those responsible for motor shows, hill-climbs, and other automobile functions. Nor were the public either.

Consequently people did not go in the numbers that were expected, and it looked as if the whole thing was going to be a "frost." Still the place was too big to stop, and it carried over an undeniable "bad time" more or less by its own momentum.

Gradually owners and manufacturers began to find what a blessing it was to have a place where one could find out accurately without falling foul of the police how fast a car could really go, and it became a genuine selling point in a car to be able to show by documentary evidence that it had done a certain officially-timed speed "at Brooklands." Consequently the track became a regular tuning-up place, and it is now pretty busy at this work almost any day of the week.

The real turning point at Brooklands, however, was reached when Mr. Holt Thomas induced Paulhan to come and give some exhibition flights after the Blackpool Meeting in November, 1909. At this time the centre of the track was all rough with tree stumps; there were ponds, ditches, bits of old buildings, and various other obstructions scattered about, though a skilful flier like Paulhan could have landed without much damage in many parts of the ground.

In readiness for Paulhan's visit, a patch of about thirty or forty acres was cleared for a starting ground, at the south end of the track away from the paddock, and a hangar was put up for him. It was a pity the start had to be made at that end, for it has resulted in the whole of "Aeropolis" being half a mile from the paddock.

Nowadays, one can go down to Brooklands on any moderately fine day—by fine I mean free from strong wind—and at a total cost of one shilling, plus what one likes to spend on an excellent tea at Mrs. Billing's "Blue Bird" tea hangar, see far finer flying than any of us saw at the great Reims Meeting, or at any of the expensive British meetings in 1910.

The solitary little shed of Paulhan has been multiplied till there are now thirty-six, making seven rows of hangars. These contain many excellent aeroplanes, some of which belong to manufacturing firms, a branch of whose business is the maintenance of flying schools, and in others new or experimental machines undergo the process of tuning up to the highest pitch of their flying capacities. One firm of aero engine builders have erected their works inside the track amongst the aeroplane sheds.

Paulhan's original forty acres have now been expanded till the whole space inside the track has been levelled and cleared. Cottages have been removed wholesale, a loop of the river has been straightened out to give more rolling ground.

There is yet another class of the community besides motorists and aviators which owes a debt of gratitude to the builders of Brooklands, and that is the motor cyclists. There is a fierce joy about motor cycle racing which is all its own, and, if one is to believe the enthusiasts, far exceeds the excitement of car racing.

But it is only since the building of Brooklands that the speed-loving motor cyclist has been able to glut his appetite to the full anywhere outside the Isle of Man. The happy owner of a sixty mile an hour machine may do his two miles in two minutes on one or two unfrequented roads in England, but it is only at the risk of finding himself either in the law court or in hospital, owing to the intervention of the police or the obtuseness of other traffic. Even in the one race of the year in the Isle of Man, with its few days of permissible training, the motor cyclist gets but a taste of speed to whet his appetite for more.

Apart from them there are general trade riders testing new engines, or new machines, for nowhere else is it possible to give an engine a full-power run for any great distance. The various long-distance races for machines under Tourist Trophy conditions have proved how little a tuning up on the road is worth, for machines which actually did well in the Isle of Man have cracked up hopelessly under the strain of a full load run of an hour or so at Brooklands.

There are still a number of people who do not see what advantage Brooklands is to the average car owner who takes no interest in track racing. The splendid performance of British cars in the Grand Prix and Coupe de l'Auto races last year was a great tribute to the Brooklands Track, as all the early experimenting and tuning up was carried out there. This convinced many waverers as to its usefulness, but there are yet others who remain unconvinced. There is not a shadow of doubt but that Brooklands has been of immeasurable benefit to the whole of the British motor industry, and a motorist in Australia or anywhere overseas who has never seen Brooklands, and who uses his car solely for touring purposes, is also benefited. Running a car at continuous full speed for hours at a stretch cannot be indulged in on any road in England; such a test carried out on the track soon locates faults that would never be discovered in an ordinary road trial. British manufacturers have recognised this fact with advantage to themselves and their clients.

Perhaps a few statistics about the track may also be interesting, so I give them herewith. (1.) A complete lap, measured to the inner edge of the track is 4.730 yards, or $2\frac{11}{16}$ miles. (2.) A full lap with the finishing straight added is $3\frac{1}{4}$ miles. (3.) The straight run in gives a full kilometre. (4.) Highest point of banking at Weybridge end, 28ft. 9in. above lower edge. (5.) Highest point at Byfleet end, 21ft. 10in. (6.) Gradient up to Weybridge banking 1 in 30. (7.) The test hill has a maximum gradient of 1 in 4. (8.) The grandstand slopes will accommodate 30,000 people.

C.G.G.

Brooklands Standard Class Records.

Holders of the Cubic Capacity and Rating Class Records at the end of 1912.

A FEW words of introduction to the tables of the Brooklands class records and their holders will not be out of place. Competition for these records has been very keen during the past year, and a great deal of interest attaches thereto.

Until the early part of 1912 the only classification was based on R.A.C. rating, the classes being known as R.A.C. Rating Classes, and a great deal of interest attaches thereto. There are six classes as follows:

R.A.C. Rating Classes.

16 Rating Class.—Engines over 12.0 and under 16.38 R.A.C. rating; minimum weight limit with driver, 1,600 lbs.

21 Rating Class.—Engines over 16.38 and under 21.00 R.A.C. rating; minimum weight limit with driver, 1,800 lbs.

26 Rating Class.—Engines over 21.0 and under 25.60 R.A.C. rating; minimum weight limit with driver, 2,000 lbs.

40 Rating Class.—Engines over 25.60 and under 40.0 R.A.C. rating; minimum weight limit with driver, 2,500 lbs.

60 Rating Class.—Engines over 40 and under 60.04 R.A.C. rating; minimum weight limit with driver, 2,700 lbs.

90 Rating Class.—Engines over 60.04 and under 90.04 R.A.C. rating; minimum weight limit with driver, 3,000 lbs.

R.A.C. RATING STANDARD CLASSES.

Class.	At 31st December, 1911.				At 31st December, 1912.			
	½ Mile.	1 Mile.	1 Kilometre.	10 Laps.	½ Mile.	1 Mile.	1 Kilometre.	10 Laps.
16	18.43 secs. 97.67 m.p.h. Vauxhall	37.93 secs. 94.91 m.p.h Vauxhall	22.14 secs. 96.67 m p h Vauxhall	18m. 9.11s. 91.46 m.p.h. Vauxhall	17.67 secs. 101 87 m.p.h. Sunbeam	36.20 secs. 99.45 m.p.h. Sunbeam	22.16 secs. 100.95 m.p.h. Sunbeam	17m. 42.51s. 93.75 m.p.h. Sunbeam
21	17.985 secs. 100.083 m.p.h. Vauxhall	37.68 secs. 95.54 m.p.h. Straker Squire	23.14 secs. 96.67 m.p.h. Straker Squire	18m. 24.003s. 90.224 m.p.h. Vauxhall	17.78 secs. 101.24 m.p.h. Vauxhall	36.14 secs. 99.61 m.p.h. Vauxhall	22.060 secs. 101.403 m.p.h. Vauxhall	17m. 14.11s. 96.32 m.p.h. Vauxhall
26	20.457 secs. 87.989 m.p.h. Hutton	Not attempted	Not attempted	21m. 40.8s. 76.55 m.p.h. Hutton	15.89 secs. 113.28 m.p.h. Talbot	32.22 secs. 111.73 m.p.h. Talbot	19.83 secs. 112.81 m.p.h. Talbot	No change
40	17.351 secs. 103.759 m.p.h. Benz	37.397 secs. 96.264 m.p.h. Benz	21.720 secs. 102.990 m.p.h. Benz	19m. 40.12s. 84.41 m.p.h. Sunbeam	No change	No change	No change	No change
60	16.506 secs. 109.051 m.p.h. Mercédès	Not attempted	20.740 secs. 107.857 m.p.h. Mercédès	16m. 18.213s. 101.778 m.p.h. Brasier	No change	33.69 secs. 106.86 m.p.h. Excelsior	20.62 secs. 108.48 m.p.h. Excelsior	No change
90	14.076 secs. 127.877 m.p.h. Benz	31.055 secs. 115.923 m.p.h. Benz	Not attempted	16m. 14.091s. 102.208 m.p.h. Napier	No change	No change	Not attempted	No change

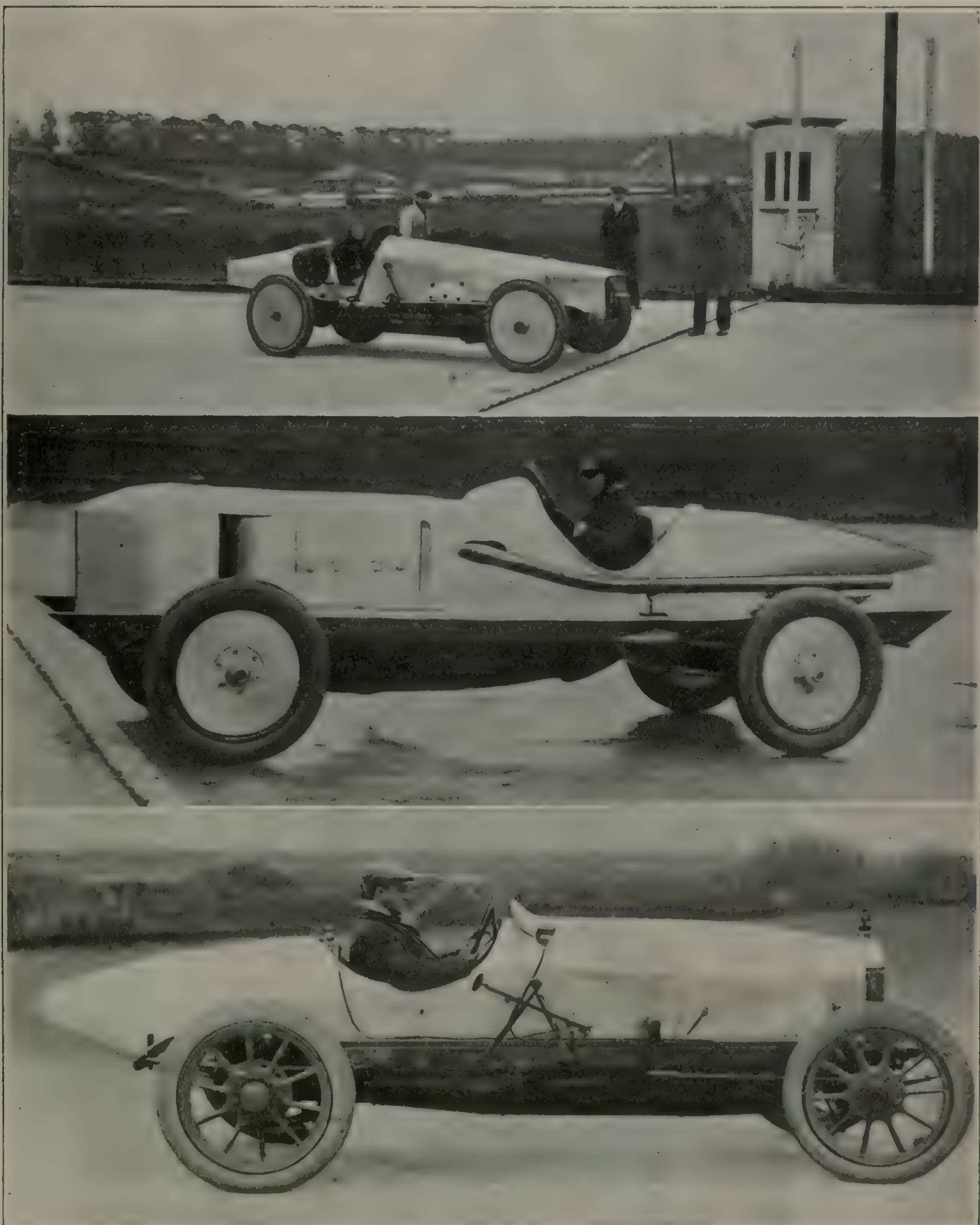
CUBIC CAPACITY CLASSES (Established 1912).

(The long distance records in the cubic capacity classes are given on the next page.)

Class.	First Records.				At 31st December, 1912.			
	½ Mile.	1 Mile.	1 Kilometre.	10 Laps.	½ Mile.	1 Mile.	1 Kilometre.	10 Laps.
A	31.93 secs. 56.37 m.p.h. Pilain	64.75 secs. 55.60 m.p.h. Pilain	39.74 secs. 56.29 m.p.h. Pilain	31m. 28.42s. 52.75 m.h.p. Stoewer	26.60 secs. 67.67 m.p.h. Stoewer	53.28 secs. 67.56 m.p.h. Stoewer	33.07 secs. 67.64 m.p.h. Stoewer	25m. 30.79s. 65.07 m.p.h. Stoewer
B	27.10 secs. 66.42 m.p.h. Calthorpe	54.47 secs. 66.09 m.p.h. Calthorpe	33.92 secs. 65.94 m.p.h. Calthorpe	27m. 24.65s. 60.56 m.p.h. Arrol Johnston	23.79 secs. 75.66 m.p.h. Calthorpe	48.46 secs. 74.29 m.p.h. Calthorpe	29.63 secs. 75.49 m.p.h. Calthorpe	24m. 51.66s. 66.78 m.p.h. D.F.P.
C	24.39 secs. 73.80 m.p.h. Crossley	49.12 secs. 73.29 m.p.h. Crossley	30.43 secs. 73.51 m.p.h. Crossley	22m. 54.62s. 72.46 m.p.h. Crossley	23.81 secs. 75.60 m.p.h. Humber	48.41 secs. 74.32 m.p.h. Humber	30.05 secs. 74.44 m.p.h. Humber	No change
D	25.27 secs. 71.23 m.p.h. Bedford	51.02 secs. 70.56 m.p.h. Bedford	31.41 secs. 71.22 m.p.h. Bedford	27m. 21.15s. 60.69 m.p.h. Argyll	18.63 secs. 96.62 m.p.h. Straker Squire	37.92 secs. 94.94 m.p.h. Straker Squire	23.18 secs. 96.50 m.p.h. Straker Squire	18m. 52.6s. 87.95 m.p.h. Straker Squire
E	17.67 secs. 101.87 m.p.h. Sunbeam	36.20 secs. 99.45 m.p.h. Sunbeam	22.16 secs. 100.95 m.p.h. Sunbeam	25m. 44.4s. 64.50 m.p.h. Star	No change	36.14 secs. 99.61 m.p.h. Vauxhall	22.060 secs. 101.403 m.p.h. Vauxhall	17m. 14.11s. 96.32 m.p.h. Vauxhall
F	15.89 secs. 113.28 m.p.h. Talbot	32.22 secs. 111.73 m.p.h. Talbot	19.83 secs. 112.81 m.p.h. Talbot	Not attempted	No change	No change	No change	Not attempted
H	16.62 secs. 108.30 m.p.h. Excelsior	33.69 secs. 106.86 m.p.h. Excelsior	20.62 secs. 108.48 m.p.h. Excelsior	16m. 19.80s. 101.66 m.p.h. Excelsior	No change	No change	No change	No change
J	Not attempted	Not attempted	Not attempted	16m. 23.78s. 101.25 m.p.h. Lor. Dietrich	Not attempted	Not attempted	Not attempted	No change

No attempts to set up records in Class G have been made.

Conspicuous Cars at Brooklands.



The Vauxhall (90 × 118 mm. 4 cyls.) *The Talbot (101·5 × 140 mm. 4 cyls.)* *The Sunbeam (80 × 149 mm. 4 cyls.)*

These illustrations are additionally interesting as showing various types of wind cutting bodies employed on the Brooklands track.

Brooklands Standard Class Records.

The R.A.C. rating, it may be added for the information of those abroad, is $\frac{D^2N}{2.5}$. Home motorists are quite familiar with it, as the taxation of cars is based on the same formula, and as it does not take any account of stroke it has come in for a good deal of criticism.

There are four records in each of these classes, *i.e.*, half a mile (flying start), ten laps (standing start), flying kilometre, and flying mile. Generally a car out for records goes for the half-mile, kilometre, and mile at one go. The ten laps—known as the long record—is not so attractive as the three shorter distances.

At the end of February, 1912, a new classification was introduced based on cubic capacity, the idea being to give the short-stroke engine the same opportunities of distinguishing itself as the long-stroke engine. These cubic capacity classes are as follows:

Cubic Capacity Classes.

Class A.—Maximum cylinder capacity, 100 cubic inches; minimum weight limit with driver, 1,400 lbs.

Class B. Cylinder capacity between 101 and 125 cubic inches; minimum weight limit with driver, 1,500 lbs.

Class C. Cylinder capacity between 126 and 150 cubic inches; minimum weight limit with driver, 1,600 lbs.

Class D.—Cylinder capacity between 151 and 175 cubic inches; minimum weight limit with driver, 1,800 lbs.

Class E.—Cylinder capacity between 176 and 235 cubic inches; minimum weight limit with driver, 2,000 lbs.

Class F.—Cylinder capacity between 236 and 305 cubic inches; minimum weight limit with driver, 2,250 lbs.

Class G.—Cylinder capacity between 306 and 475 cubic inches; minimum weight limit with driver, 2,500 lbs.

Class H.—Cylinder capacity between 476 and 850 cubic inches; minimum weight limit with driver, 2,700 lbs.

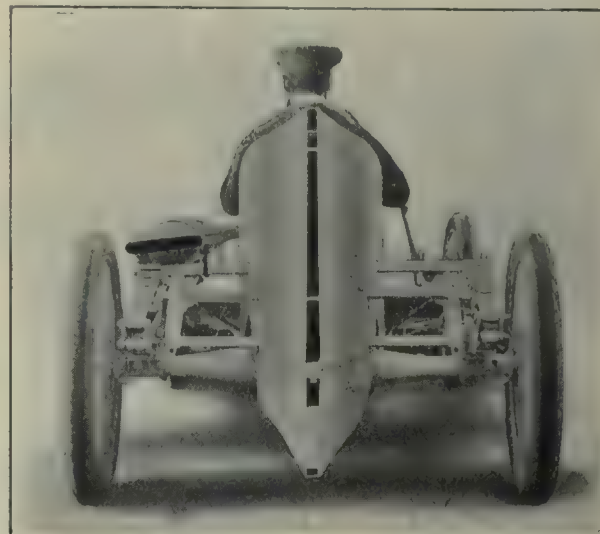
Class J.—Cylinder capacity exceeding 850 cubic inches; minimum weight limit with driver, 3,000 lbs.

It is important to note that the cubic capacity classes have not superseded the rating classes. The latter still exist, and it is possible to go for records on either classification or for both. Since their introduction, however, the c.c. rating records have attracted the greater amount of attention.

It is interesting to compare the two classifications and to see into what rating class would fall a car out for a particular record in a cubic capacity class, etc.:

Cubic capacity classes.	R.A.C. rating classes.
A B C	16
D E	21
F	26
G	40
H	60
J	90

Apart from the Brooklands standard class records over the four regulation distances, long distance records on the cubic capacity classification have been established in three of the classes, *i.e.*, B, E, and J. Holders of these long distance records at the end of 1912 are given below.



End view of an Austin Brooklands racing car showing shape of tail, exhaust pipe, and the single seated body.

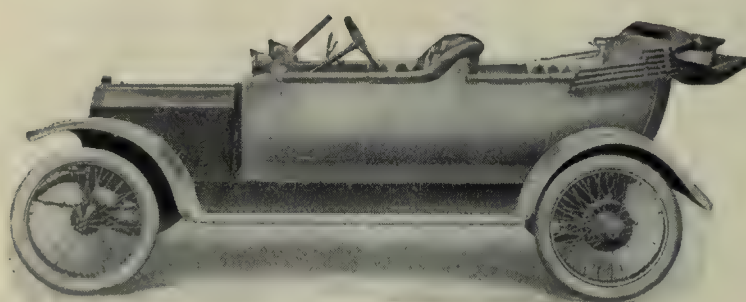
LONG DISTANCE RECORDS IN BROOKLANDS CUBIC CAPACITY CLASSES.

Record.	Car.	Holder.	Performance. Miles.	Yds.	M.P.H.	Record.	Car.	Holder.	Performance. H.	M.	S.	M.P.H.
						CLASS B.						
1 hour	Arrol-Johnston	T. C. Pullinger	61	63	61.03	50 miles	Arrol-Johnston	T. C. Pullinger		49	14.95	60.91
2 hours	,,	,,	122	1054	61.29	100 ,,	,,	,,	1	38	1.75	61.21
3 ,,	,,	,,	182	1011	60.86	150 ,,	,,	,,	2	28	34.49	60.57
4 ,,	,,	,,	245	343	61.29	200 ,,	,,	,,	3	16	42.89	61.00
5 ,,	,,	,,	305	1146	61.13	300 ,,	,,	,,	4	54	36.46	61.10
6 ,,	,,	,,	368	742	61.40							
						CLASS E.						
1 hour	Sunbeam	L. Coatalen	79	1673	79.95	50 miles	Vauxhall	P. C. Kidner		30	52.74	97.15
2 hours	,, ...	,,	158	994	79.28	100 ,,	Sunbeam	L. Coatalen	1	14	41	80.34
3 ,,	,, ...	,,	237	98	79.02	150 ,,	,, ...	,,	1	53	42	79.15
4 ,,	,, ...	,,	319	242	79.78	200 ,,	,, ...	,,	2	30	32.6	79.71
5 ,,	,, ...	,,	391	1429	78.36	300 ,,	,, ...	,,	3	45	53.5	79.68
6 ,,	,, ...	,,	444	524	74.05	400 ,,	,, ...	,,	5	5	53.36	78.46
7 ,,	,, ...	,,	509	501	72.76	500 ,,	,, ...	,,	6	52	58.4	72.65
8 ,,	,, ...	,,	588	704	73.55	600 ,,	,, ...	,,	8	8	30.2	73.69
9 ,,	,, ...	,,	667	1438	74.19	700 ,,	,, ...	,,	9	23	41.2	74.51
10 ,,	,, ...	,,	751	1531	75.19	800 ,,	,, ...	,,	10	39	5.7	75.11
11 ,,	,, ...	,,	827	942	75.23	900 ,,	,, ...	,,	11	52	3.2	75.83
12 ,,	,, ...	,,	910	1738	75.92	1000 ,,	,, ...	,,	13	8	25.1	76.102
13 ,,	,, ...	,,	987	1548	75.99							
						CLASS J.						
1 hour	Lorraine-Dietrich	W. M. Letts	97	1037	97.59	50 miles	Lorraine-Dietrich	W. M. Letts		29	31.46	101.61
2 hours	,,	,,	189	1747	94.99	100 ,,	,,	,,	1	1	27.69	97.62
3 ,,	,,	,,	284	817	94.82	150 ,,	,,	,,	1	31	52.06	97.97
4 ,,	,,	,,	344	1344	86.19	200 ,,	,,	,,	2	5	58.73	95.51
5 ,,	,,	,,	422	1574	84.59	300 ,,	,,	,,	3	32	57.08	84.57
6 ,,	,,	,,	518	312	86.36	400 ,,	,,	,,	4	34	23.87	87.46
						500 ,,	,,	,,	5	48	38.87	86.05

No records for the long distances have been established in Classes A, C, D, F, and G.

B. S. A.

The Car for the OWNER-DRIVER.



Four-seater, with hood, screen, lamps, and horn, £325.

Two-seater, with hood, screen, lamps, and horn, £310.

Dynamo electric lighting equipment, £25 extra.

For those who are as particular about having the best as we are about making it—and for dealers who are as particular about selling the best.

Catalogue upon application.

The Birmingham Small Arms Co., Ltd.,

Motor Department: SPARKBROOK, BIRMINGHAM.

Hill-climbs and Races.

The Principal Open Events of 1912 summarised, together with the results of the same events since they were instituted.

For Brooklands Rating Class Records see page 42. For World's Records confirmed by the International Association of Recognised Automobile Clubs see page 46.

The Targa Florio Race.

THE Targa Florio Race is the classic Italian event of the year. The 1912 event took place as usual in Sicily (May 26th and 27th), over a total distance of 1,050 kilometres (656 miles), and the total time occupied by the winner, Mr. Cyril Shipe, of Manchester (S.C.A.T.), was 23h. 37m. $19\frac{4}{5}$s. = 27.77 m.p.h. The race started at midnight, competitors driving all through the night. This and the fact that the course was very hilly with bad surface and dangerous corners doubtless account for what at first appears to be a low average speed. The following list shows the winners of the Targa Florio since it was inaugurated in 1906:

1906.—Cagno (Itala).
1907.—Nazzaro (F.I.A.T.).
1908.—Trucco (Isotta-Fraschini).
1909.—Cuippa (S.P.A.).
1910.—Cariolato (Franco).
1911.—Ceirano (S.C.A.T.).
1912.—Cyril Snipe (S.C.A.T.).

The Shelsley Walsh Hill-climb.

The Shelsley Walsh open hill-climb is an annual event organised by the Midland Automobile Club, and for some years it has come to be regarded as the principal fixture of its kind. The 1912 event was held on June 22nd, when first place on formula was secured by C. Bianchi (15 h.p. Crossley), G. Day (12 h.p. Talbot) being second. First and second fastest times were made by J. Higginson (80 h.p. La Buire) and O. Thorlander (22-80 h.p. Austro-Daimler) respectively. The foregoing are the results of the open event only. The La Buire failed to beat the record time for the hill, which stands to the credit of a 58 h.p. Daimler driven by H. C. Holder in 1911. The following is a list of the winners (both time and handicap) since the Shelsley Walsh hill-climb was inaugurated in 1906:

Handicap.	Fastest time.	Secs.
1906.—T. W. Huband (Alldays).	F. A. Coleman (White Steam) ...	80.6
1907.—T. W. Bowen (Talbot).	J. E. Hutton (Berliet)	67.2
1908.—P. C. Kidner (Vauxhall).	S. F. Edge (Napier) ...	65.4
1909.—P. C. Kidner (Vauxhall).	H. C. Holder (Daimler)	68.4
1910.—R. Lisle (Star).	O. S. Thompson (Austin) ...	70.2
1911.—P. C. Kidner (Vauxhall).	H. C. Holder (Daimler)	63.4
1912.—C. Bianchi (Crossley).	J. Higginson (La Buire)	68.8

The Grand Prix and Coupe de l'Auto Races.

The year 1912 will long be remembered by motorists at home and abroad as the year in which British-built cars secured such a conspicuous success in the race for the Grand Prix and Coupe de l'Auto—by far the most important race of the year. The scene of the contest was the Dieppe (France) circuit, and the distance 956 miles. The two events were run off simultaneously. The Grand Prix was the "unlimited" class; cars in the Coupe de l'Auto were restricted to an engine capacity of 3 litres, and a minimum weight was insisted upon. The cars in the 3 litre class thus came automatically into the unlimited class as well, and, as the results proved, there was very little difference between the average speeds of the winner of the Grand Prix and the winner of the Coupe de l'Auto. Further, the latter came third in the general classification. The racing was spread over two days, the cars being placed under lock and key at the end of the first day's racing until half an hour before the commencement of the final instalment. The Grand Prix was won for France by Boillot (Peugeot, four cylinders, 110 × 200 mm.), and the Coupe de l'Auto was won for England by Rigal (Sunbeam, four cylinders, 80 × 149.8 mm.). The English Sunbeams also won the team prize. The following table of the final times and average speeds of the cars that finished indicates the small difference of speed between the "big" cars and the "small" cars. It also shows the comparative sizes of the engines:

Order in Unlimited Class.	Driver and Car.	Order in Limited Class.	Time.	Speed.	Engine Capacity.
			h. m. s.	m.p.h.	c.c.
1	Boillot, Peugeot	–	13 58 $2\frac{3}{5}$	68.45	7,600
2	Wagner, F.I.A.T.	–	14 11 $8\frac{3}{5}$	67.32	14,143
3	Rigal, Sunbeam	1	14 38 36	65.29	2,990
4	Resta, Sunbeam	2	14 39 $51\frac{4}{5}$	65.23	2,990
5	Médinger, Sunbeam ..	3	15 59 $41\frac{2}{5}$	59.78	2,990
6	Christiaens, Excelsior	–	16 23 $38\frac{4}{5}$	58.30	9,130
7	Croquet, Schneider ...	4	17 31 $39\frac{1}{5}$	54.54	2,811
8	Anford, Rolland-Pilain	–	17 49 32	53.63	6,274
9	Wyse, Arrol-Johnston	5	18 7 $19\frac{1}{5}$	52.75	2,811
10	Duray, Alcyon	6	18 28 $55\frac{1}{5}$	51.73	2,996
11	Vonlatum, Vinot	7	19 0 6	50.31	2,985
*12	Esser, Mathis	–	20 18 5	47.11	1,843
13	Vere, Cote	8	20 57 6	45.63	2,985

*Competed in unlimited class because its weight was considerably under the minimum for the limited class.

Previous Grand Prix races have resulted as follows:

Year.	Driver and Country	Car.	Distance.	Average Speed.
			miles.	m.p.h.
1906	Sisz, France	Renault	750	63.0
1907	Nazzaro, Italy	F.I.A.T.	477	70.5
1908	Lautenschlager, Germany..	Mercédès	477	69.0

There were no races in 1909, 1910, and 1911.

Winners of Gordon-Bennett Races.

Although the international Gordon-Bennett Race is now defunct, its place having been taken by the Grand Prix, the results of the annual races for the G.B. cup which were held from its institution until it was superseded in 1906 are worthy of record:

Year.	Driver and Country.	Car.	Distance.	Average Speed.
			miles.	m.p.h.
1900	Charron, France	Panhard	352	[illegible]
1901	Girardot, France	Panhard	[illegible]	37.0
1902	Edge, Great Britain	Napier	367	31.8
1903	Jenatzy, Germany	Mercédès	368	49.2
1904	Théry, France	Brasier	351	54.5
1905	Théry, France	Brasier	341.5	48.5

Winners of Previous Light Car Races.

Since 1906 there has been held in France every year a race for small cars. It has been known variously as the Coupe des Voiturettes, the Grand Prix des Voiturettes, the Coupe des Voitures Légères, and

Hill-climb and Races.

last year as the Coupe de l'Auto. The first four races are notable for the poor showing made by the four-cylinder cars which were entered; it was a foregone conclusion that one of the cars fitted with abnormal single-cylinder engines would win. The Lion Peugeot which won in 1909 had a two-cylinder V engine 80 × 192 mm. The race was won for the first time by a four-cylinder car in 1910, the Hispano-Suiza having four cylinders 65 × 200 mm. The 1911 race was the first event in which the principal regulation was that the cylinder capacity should not exceed three litres. It was the first race won by a "normal" car, the winning Delage having a four-cylinder engine, the dimensions of which were 80 × 149 mm. It will be noticed that the Sunbeam speed in the 1912 race was a great advance upon that of the Delage in 1911, actually 65.29 m.p.h. compared with 54.8 m.p.h. Both engines were of approximately the same dimensions. Results of these small car races are:

		Average Speed. m.p.h.
1906.	Sizaire (Sizaire-Naudin) ...	31.42
1907.	Naudin (Sizaire-Naudin)	40.66
1908.	Naudin (Sizaire-Naudin)	47.46
1909.	Guippone (Lion-Peugeot)	47.44
1910.	Zuccarelli (Hispano-Suiza)	55.6
1911.	Bablot (Delage) ...	54.8
1912.	Rigal (Sunbeam) ...	65.29

The R.A.C. Standard Car Race.

The Standard Car Race was held by the Royal Automobile Club at Brooklands on July 16th, 1912. As the name of the event implies, the chassis had to be of standard design, and shown in the manufacturer's or agent's catalogue, except for size of petrol tank, rake of steering, and adjustment of carburetter. The conditions further stated that no specially designed speed model, although it might be catalogued, would be admitted; the Star cars (which make was first and second in the 1911 event) were disqualified for the latter reason. The fact that standard gear ratios had to be used also deterred some well-known competition firms from entering.

The race was over a distance of 100 laps (= 277 miles approx.), and it was won by a 20 h.p. Singer, second place being secured by a 12-14 h.p. Gladiator. The great struggle between these two cars—the Singer finishing only two lengths (= $2/5$s.) in front of the Gladiator—throughout the whole race was the outstanding feature. Eight cars started and three finished:

Car.	Bore and Stroke.	Cubic Capacity	No. of Speeds.	Top Gear Ratio.	Size of Tyres.
	mm.	c.c.			mm.
Singer	90 × 130	3,307	4	3.5 to 1	815 × 105
Gladiator ...	80 × 110	2,208	3	3.26 to 1	810 × 90
Turcat-Méry	90 × 130	3,307	4	4 to 1	875 × 105

The average speed of the winner = 57.49 m.p.h.

The 1911 event was won by a Star car (four cylinders, 80 × 120 mm.) at an average speed of 56.247 m.p.h. In 1911 no cars exceeding 16 R.A.C. rating were eligible. In 1912 cars up to 20 rating were accepted.

World's Records.

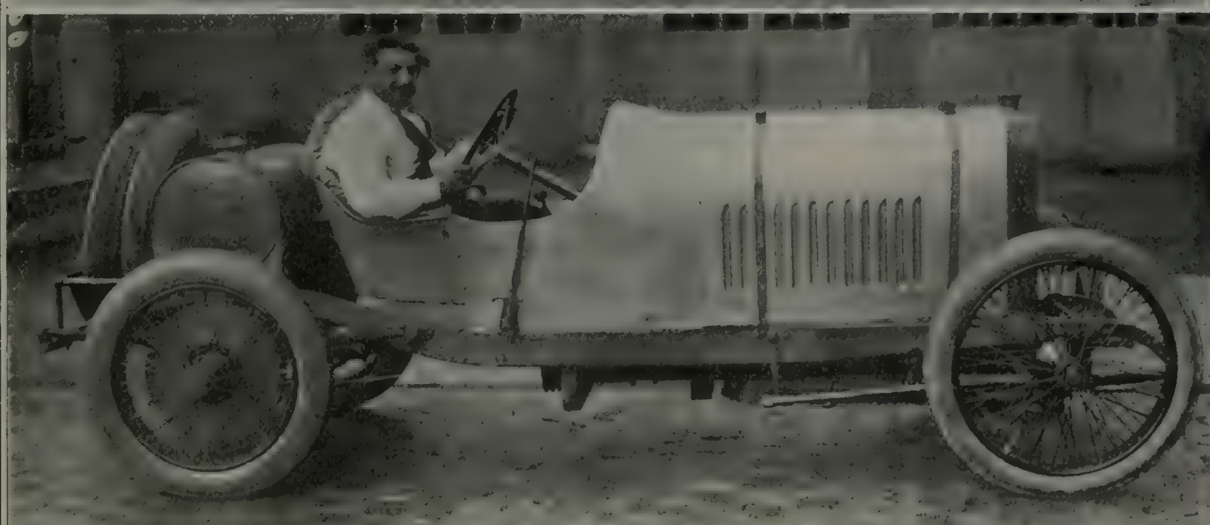
As accepted by the International Association of Recognised Automobile Clubs.

A World's Record may be beaten but it is not entitled to be so termed until it has been passed by the International Association of Recognised Automobile Clubs which meets in Paris every December. The following table shows the present holders of Worlds' Records as approved by the Association in December, 1912, and also the same Records as they stood twelve months previously for purposes of comparison. Although a World's Record can be established anywhere it is interesting to note that the Records standing to-day have all been made on the Brooklands track.

Record.	As at 31st December, 1911.			As at 31st December, 1912.		
	CAR.	H. M. S.	M.P.H.	CAR.	H. M. S.	M.P.H.
½ mile f.s.	84.8 h.p. Benz	14.076	127.877	No change		
,, s.s.	,,	25.566	70.406			
Kilometre f.s.	,,	17.761	125.947			
,, s.s.	,,	31.326	71.409			
Mile f.s.	,,	31.055	115.923			
,, s.s.	,,	41.268	87.233			
50 miles	59.9 h.p. Thames	32 50.99	91.32	45 h.p. Excelsior	29 18.45	102.36
100 ,,	,,	1 6 53.49	89.70	59.6 h.p. Lorraine-Dietrich	1 1 27.69	97.62
150 ,,	,,	1 44 30.16	86.12	,, ,,	1 31 52.06	97.97
200 ,,	,,	2 17 56.36	87.01	,, ,,	2 5 58.73	95.51
300 ,,	,,	3 30 17.54	85.60	No change		
400 ,,	30.1 h.p. Sunbeam	5 20 30.96	74.88	59.6 h.p. Lorraine-Dietrich	4 34 23.87	87.46
500 ,,	,,	6 40 16.45	74.95	,, ,,	5 48 38.87	86.05
600 ,,	,,	7 57 59.55	75.32	No change		
700 ,,	,,	9 16 34.02	75.46			
800 ,,	,,	10 34 29.88	75.65			
900 ,,	,,	11 53 36.79	75.68	15.9 h.p. Sunbeam	11 52 3.2	75.83
1000 ,,	60 h.p. Napier	14 54 15.4	67.09	,,	13 8 25.1	76.102
		MILES. YARDS.			MILES. YARDS.	
1 hour	59.9 h.p. Thames	89 892	89.50	59.6 h.p. Lorraine-Dietrich	97 1037	97.59
2 hours	,,	173 810	86.73	,, ,,	189 1747	94.99
3 ,,	,,	261 1653	87.31	,, ,,	284 817	94.82
4 ,,	30.1 h.p. Sunbeam	300 1421	75.20	,, ,,	344 1344	86.19
5 ,,	,,	373 135	74.21	,, ,,	422 1574	84.59
6 ,,	,,	451 445	75.20	,, ,,	518 312	86.36
7 ,,	,,	525 568	75.05	No change		
8 ,,	,,	602 971	75.32			
9 ,,	,,	678 158	75.34			
10 ,,	,,	757 248	75.71			
11 ,,	,,	832 1704	75.72			
12 ,,	,,	907 1535	75.66	15.9 h.p. Sunbeam	910 1738	75.92
13 ,,	60 h.p. Napier	866 330	66.63	,,	987 1548	75 99
24 ,,	,,	1581 1310	65.905	No change		

Winners of the Chief Road Races of Last Year.

FOR DETAILS OF THESE EVENTS SEE PAGES 45 AND 46.



Rigal (Sunbeam), 1st in the Coupe de l'Auto. Boillot (Peugeot), 1st in the Grand Prix. Snipe (S.C.A.T.), 1st in the Targa Florio.

R.A.C. Horse-power Tests at Brooklands.*

The Wimperis Accelerometer in Conjunction with Accurate Timing and Weighing.

A HIGHLY interesting series of tests was carried out on the track at Brooklands on July 19th, 1912, with a Wimperis accelerometer. By means of this instrument, it is claimed, the brake horse-power of an engine at the flywheel may be obtained without any of the paraphernalia that such an undertaking would ordinarily involve. The horse-power reading results from the simplification of a formula composed of two easily determinable factors, a figure supplied by the instrument in question, and a constant. For the use of the Technical Committee between twenty-five and thirty cars were loaned for the trials, the results of which are given below.

Starting from the paddock, each car, furnished with a Wimperis accelerometer, entered the oval of the track at the "fork," and was driven at its maximum speed over the measured half-mile alongside the railway. About ten yards beyond the measured stretch, with the car still going at its maximum speed, the clutch was disengaged, thereby causing the car to slow down, and the rate at which deceleration took place supplied the important factor of the test. The Wimperis instrument is graduated to show the deceleration or retardation of the vehicle in pounds per ton, and, if the figure indicated by the accelerometer pointed be employed in the formula

$$\frac{\text{Velocity (m.p.h.)} \times \text{Retardation (lb. per ton)} \times \text{Total weight of vehicle}}{375}$$

the simplification of the latter will give the horse-power developed by the engine when propelling the car at its highest speed. The cars used for the experiments differed widely in horse-power and weight, and the results as given below should prove distinctly educational.

The ease with which each car was tested may be gathered from the fact that all of them were dealt with in about four hours. No delicate adjustments were necessary beyond the levelling up of the accelerometer on the vehicle. The instrument is of a handy size; the circular dial is about 3½in. in diameter, with graduations indicating acceleration or deceleration on each side of the central zero mark. Inside the instrument there is a vertical spindle, which carries a pointer on the end that projects through the dial. At the opposite end, and inside the casing, a copper disc, having an eccentric centre of gravity, is mounted. This disc is controlled by a light spiral hair-spring, and is damped magnetically. In its natural state the position of the disc is such that the pointer (which is carried on the same spindle as the disc) is over the zero mark on the dial. When the instrument is caused to move forward in the direction of the arrow shown on the dial, the centre of gravity of the disc tends to lag behind, and thereby rotates the disc and the pointer through an angle controlled by the spring.

For example, we will assume that the instrument is placed on a car: when the first speed is engaged and the clutch let in, the pointer will fly back over the acceleration scale; as acceleration decreases, the needle will approach the zero mark, which will be reached as soon as the car travels at a constant speed. Similarly, when slowing down, the magnitude of the retardation is measured on the opposite scale.

Method of Tests.

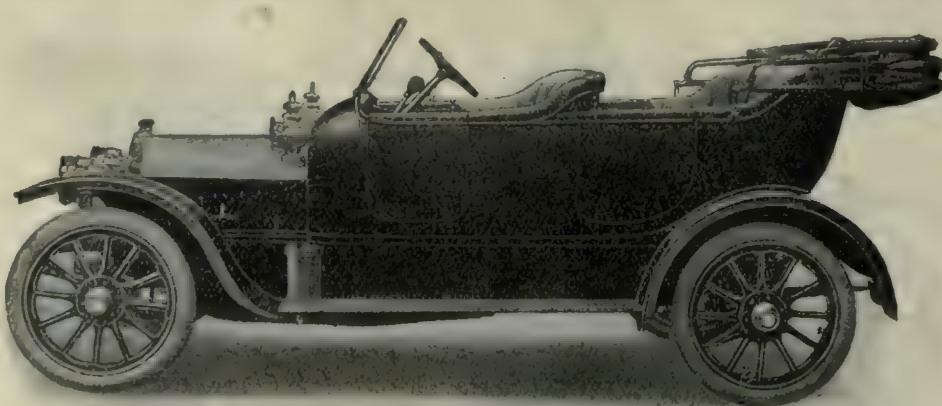
Twenty-seven cars were tested. It will be seen that a number of old cars were included, and for the first time it has been possible to ascertain the relative horse-power of a number of new and old cars of

GENERAL RESULTS.

TABLE I.

Car No.	Maker's H.P.	No. of Seats.	Date.	Bore and Stroke.	No. of Cyls.	R.A.C. Rating.	Displacement.	W = Weight as Run.	V = Maximum Speed.	R = Resistance.	B.H.P.	Gear Ratio.	Rear Tyres.
				mm.			c.c.	tons.	m.p.h.	lbs. per ton.			mm.
1	—	4	1905	127 × 127	1	9.9	1583	1.04	24.0	90	6	4.0	760
2	15	4	1908	98 × 114	4	23.8	3440	1.32	36.44	135	17½	—	810
3	12-16	4	1912	79 × 121	4	15.5	2352	1.36	42.45	155	24	4.37	810
4	14-20	4	1912	80 × 130	4	15.9	2610	1.44	36.73	135	19	—	—
5	10-12	2	1912	90 × 120	2	10.0	1526	1.30	38.14	150	20	4.38	760
†6	18-24	-	1911	90 × 130	4	20.1	3307	1.88	40.72	120	24½	3.78	920
7	15	4	1911	70 × 170	4	12.1	2611	1.20	44.33	185	26	—	810
8	12-16	4	1910	79 × 114	4	15.5	2235	1.25	40.36	118	16	4.4	810
9	10-12	4	1909	102 × 110	2	12.9	1797	1.18	28.75	92	8½	4.12	760
10	10-12	2	1912	75 × 110	4	13.96	1940	1.08	37.19	175	18½	4.285	760
11	16-20	4	1907	95 × 135	4	22.4	3828	1.46	37.97	130	19	2.88	880
12	20-28	4	1911	102 × 130	4	25.8	4248	1.67	44.78	165	33	3.3	820
14	15	4	1912-13	89 × 127	4	19.6	3170	1.62	38.96	145	24½	4.0	820
15	18-30	4	1911	100 × 130	4	24.8	4082	1.91	39.47	110	22	3.37	880
16	26	4	1912	102 × 178	4	25.8	5818	1.98	49.72	165	43½	3.25	880
17	20	4	1910	102 × 140	4	25.8	4575	1.45	56.25	220	48	—	—
18	12-16	2	1907	82 × 120	4	16.7	2535	1.00	41.10	105	11½	3.0	760
19	15	4	1910	85 × 110	4	17.9	2497	1.36	34.09	125	15½	4.0	815
20	18	4	1912	90 × 130	4	20.1	3307	1.67	44.78	175	33½	4.0	820
21	12	4	1912	75 × 130	4	13.96	2298	1.21	40.00	140	18	4.7	810
22	12	2	1903	80 × 120	4	15.9	2409	1.05	24.52	120	8	3.0	810
23	12-16	2	1912	80 × 150	4	15.9	3012	1.20	46.88	130	19½	—	—
24	—	4	1909	106 × 170	4	27.8	6001	1.71	51.43	175	41	3.4	815
25	12	4	1912	75 × 130	4	13.96	2298	1.26	43.48	195	28½	4.7	810
30	15	4	1910	80 × 120	4	15.9	2409	1.38	37.66	160	22	—	—
32	15.9	[illegible]	1912	80 × 120	4	15.9	2409	1.35	43.27	115	18	—	—
33	15	4	1905	90 × 120	4	20.1	3052	1.37	30.3	100	11	—	—

*Extracts from the official report issued by the Royal Automobile Club. †Closed body.



STAR CARS

"The CAR with the finest Engine in the World."

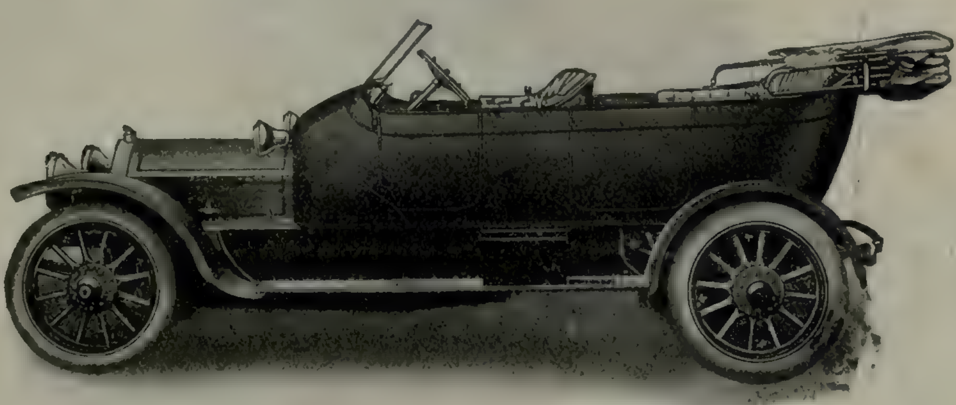
WHAT SHOULD APPEAL TO YOU, the

STAR 15·9.

The Car which made the remarkable performance on Brooklands, Aug. 30th, 1912, 801 MILES 1,530 YARDS IN 12 HOURS, at an average of 66¾ m.p.h., and it must be remembered that this was with a model to standard specification in every detail, and not a car specially built for racing purpose.

Price £395 complete,

With Five-seater Torpedo Body, Cape Cart Hood, Screen, Five Lamps, and Five Detachable Wheels, Horn, Full Kit of Tools, etc.



various sizes and makes. As previously mentioned, the b.h.p. figures are obtained from the formula

$$B.H.P. = R \times W \times V \div 375$$

where R is the resistance to motion measured at the clutch in pounds per ton, W is the car weight in tons, and V is the speed in m.p.h.

Gear Ratios and Wheel Diameters.

On Dr. Dugald Clerk's suggestion, the Club has endeavoured to obtain from the owners of the cars particulars of gear ratios on top gear, diameters of rear road wheels, and information as to whether the top gear was a direct drive or not. The purpose for which these additional particulars were desired was to get figures for the engine r.p.m. at top speed, the piston speed at that point, and the brake mean effective pressure (ηP). Table II. gives the additional data so collected.

Comparison with R.A.C. Rating and Effect of Age.

A point of interest in the tests is that it enables a comparison to be made of b.h.p. with R.A.C. rating, not only for new cars but for old ones. It will be seen that the b.h.p. is greater than the R.A.C. rating in the case of 1911 and 1912 cars. The great loss in relative power in passing from the 1909-10 group to the 1907-8 cars is marked, and indicates an advance in motor car design in the intervening period. It will be seen that cars four or five years old give on the average half the b.h.p. of new cars of the same R.A.C. rating.

Engine and Piston Speeds and Mean Effective Pressures

In Tables II., III., and IV. are given the engine and piston speeds and the mean effective pressures for new (1911-12), middle-aged (1908-10), and old (1903-7) cars. The engine speed (mean) is 1,689 for the new, 1,615 for the middle-aged, and 972 for the old. There seems, therefore, to have been little increase in engine speed in the last three or four years, but a material advance between the old and middle-aged. The low engine speed of the old car is, however, due in part to the fear of damage to engine or car if the throttle were opened to its full extent. The mean piston speed for new cars is 1,439 feet per minute, compared with 1,358 for the middle-aged, and 817 for the old. The mean effective pressures are striking. The new cars give values almost identical with that assumed in the R.A.C. rating, viz., 67.2. Middle-aged and old cars have about the same mean pressures, viz., 50 and 54, suggesting that the loss of pressure due to piston and valve leakage and to lower mechanical efficiency gets to its maximum when the car is still only middle-aged, and that the further drop in h.p. is due to the lowness of piston speed of the very old cars.

Accuracy of Measurement.

When these tests were decided upon, it was expected to get readings to within five per cent., and it is interesting, in conclusion, to examine into the probable accuracy achieved. The figures for R (resistance in lbs. per ton) may be taken as ± 5 lbs. per ton, or, on the average, some three per cent. above or below the correct figure. (When tests are made on a downward slope the accuracy is very much greater, as there is more time to make the observations, and the complicating effect of rotational momentum is almost wholly absent.) The momentum stored in the rotating parts of the car tends to keep up the speed of the car when coasting on a level road, and this effect may make the reading of R (resistance) some 2% or 3% low. The fact that the "straight" at Brooklands is approached from a downward slope tends to make the speed a little higher than it would be if due to the engine alone, and this tends to make the readings high, thus more or less balancing the effect of rotational momentum. The above considerations apply to the four-seater cars; in the case of the two-seaters the only place for the Wimperis accelerometer was on the floorboards, and, as these were not, in general, screwed or fastened down, there was uncertainty as to whether they may not have shifted. Great care was taken to minimise the chances of error on this account, but all observers can testify to the difficulty of so doing. For this reason the measurements made on the two-seater cars were not so accurate as those made on the four-seater cars, but it is impossible to say precisely to what extent.

TABLE II.—Engine R.P.M., Piston Speed, Mean Effective Pressure (ηP), and Stroke-bore Ratio for Ten New Cars (1911-1912).

Car No.	Engine.	Piston Speed.	ηP.	Stroke-bore.
	r.p.m.	ft. per min.		
3	1,950	1,550	68	1.53
5	1,870	1,470	91	1.33
6	1,430	1,220	67	1.44
10	1,790	1,290	69	1.47
12	1,540	1,310	65	1.27
14	1,620	1,350	62	1.43
15	1,290	1,100	54	1.30
16	1,560	1,820	62	1.75
20	1,860	1,590	71	1.44
21	1,980	1,690	51	1.73
Average ...	1,689	1,439	66	1.47

TABLE III.—Engine R.P.M., Piston Speed, ηP, and Stroke-bore Ratio for Four Middle-aged Cars (1908-1910 inclusive).

Car No.	Engine.	Piston Speed.	ηP.	Stroke-bore.
	r.p.m.	ft. per min.		
8	1,870	1,400	50	1.44
9	1,330	960	46	1.08
19	1,430	1,030	56	1.29
24	1,830	2,040	49	1.60
Average ...	1,615	1,358	50.2	1.35

TABLE IV.—Engine R.P.M., Piston Speed, ηP., and Stroke-bore Ratio for Three Old Cars (1903-1907 inclusive).

Car No.	Engine.	Piston Speed.	ηP.	Stroke-bore.
	r.p.m.	ft. per min.		
1	1,080	900	45	1.00
11	1,060	940	61	1.42
22	775	610	56	1.50
Average ...	972	817	54	1.31

A great deal has been written of late calling the attention of British manufacturers to the firm grip American firms are getting on the Colonial market. This is especially marked in Australia, and particularly in the State of New South Wales. To those at home who up to the present have not been inclined to take these reports seriously the following figures relating to cars exhibited at the 1912 Sydney Motor Show should appeal. There were 87 different makes of car on view, and this total was made up as follows:

31 from U.S.A.
26 from Great Britain.
20 from France.
4 from Italy.
3 from Germany.
3 from Belgium.

Road Racing in the Isle of Man.

THE Isle of Man has always figured prominently in the history of automobilism, as it is there that all the long-distance motor road races—both motor cycle and car—held in Great Britain have taken place, with the exception of the 1903 Gordon-Bennett Race which was run off in Ireland. In the days of the Gordon-Bennett Races, the Isle of Man was the place selected for holding the elimination trials in order to decide upon the English teams, and afterwards it figured as the scene of the Tourist Trophy and Four Inch Races. No car race has been held there since 1908, but there is every probability of a race for touring chassis taking place in 1913 under the auspices of the R.A.C.

1905.

The first Tourist Trophy (1905) held by the Royal Automobile Club was the first serious attempt at a long-distance road race for touring cars, and that a great deal of valuable knowledge was gained by manufacturers from this and subsequent similar events has never been doubted. The outstanding feature of the 1905 race was that the petrol was limited to one gallon for each 22.54 miles. Each chassis had to weigh at least 1,300 lbs. (11½ cwts.) and not more than 1,600 lbs. (14¼ cwts.), and carried a load composed of the carriage work, the driver, passenger and ballast of 950 lbs. Four-seated bodies were specified.

The race took place on September 14th, 1905, over four circuits of the Isle of Man course, making a distance of 208.5 miles. Forty-two cars started, eighteen finished; the first three places being secured by the following:

Driver and Car.	No. of Cylinders.	Bore and Stroke.	No of Speeds	Average Speed.
		mm.		m.p.h.
1. Napier, Arrol-Johnston	2 (4 pistons)	120 × 165	4	33.9
2. Northey, Rolls-Royce	4	101 × 127	4	33.7
3. Littlejohn, Vinot	4	90 × 130	3	33.3

1906.

The following year (1906) somewhat less petrol was allowed, competitors being limited to one gallon for every twenty-five miles as compared with one gallon for every 22.5 miles of the previous year. The chassis had to carry a minimum load of 1,175 lbs. (10½ cwts.) made up of the body, driver, passenger and ballast. The race was run on September 27th, twenty-nine cars starting, the results being as follows:

Driver and Car.	No. of Cylinders.	Bore and Stroke.	No. of Speeds	Average Speed.
		mm.		m.p.h.
1. Rolls, Rolls-Royce ...	4	101 × 127	4	39.3
2. Bablot, Berliet	4	100 × 120	4	35 4
3. Lee Guinness, Darracq	4	90 × 120	4	34.2

1907.

In 1907 competitors were divided into two classes—those who entered for the Tourist Trophy, and those who entered for the Heavy Car Race. These were two separate races, although they were run simultaneously on May 30th. As on previous occasions, the fuel allowance was the principal regulation. In the case of the Tourist Trophy cars, it was at the rate of one gallon for every twenty-five miles. The load to be carried on the chassis was 12½ cwts.

The Heavy Car Race, as its name implies, was for a larger type of car, the fuel allowance being at the rate of one gallon for every sixteen miles, and the minimum load to be carried on the chassis 20 cwts. The small cars covered 241.6 miles, and the big cars 281.8 miles. To provide the equivalent of resistance to the air offered by a covered-in body, the Heavy Car competitors had to carry (in addition to the one ton load) a wooden screen behind the front seats, the dimensions of which had to be 8ft. from the ground to the top, and 5ft. 3in. wide.

In the Tourist Trophy Race twenty-two cars started and only the following two finished:

Driver and Car.	No. of Cylinders.	Bore and Stroke.	No. of Speeds	Average Speed.
		mm.		m.p.h.
1. Courtis, Rover	4	97 × 110	4	28.8
2. Reid, Beeston-Humber	4	105 × 130	4	28.1

The Heavy Car Race resulted as follows:

Driver and Car.	No. of Cylinders	Bore and Stroke.	No. of Speeds	Average Speed.
		mm.		m.p.h.
1. Mills, Beeston-Humber	4	120 × 160	4	28.7
2. Fenton, Gladiator	4	105 × 140	4	26.7

Nine cars started and only the above two finished.

From the above times it will be noticed that the average speeds achieved in both races were less than those made in 1905 and 1906. The reason for this was the extremely bad climatic conditions which prevailed; the roads were extremely heavy, and it rained and blew a gale throughout the day. The two previous events had been run in fine weather.

1908.

The fuel limit was dropped in 1908, a limit on engine bore being used instead. The only restrictions were that the bore should not exceed 4in. (101.6 mm.) for a four-cylinder engine, and that the weight of the chassis should not be less than 1,800 lbs. (16 cwts.) This total excluded the driver, mechanic, spares and tools. Apart from the engine limit instead of the fuel limit another great difference in this year's event was that it was a chassis race; the regulations of the 1905-6-7 events stipulated four-seated bodies being carried.

No limit being placed on the stroke of the engine it followed that some very long strokes were adopted, and the fact that the engine of the winning car had a stroke of 7in. (177.8 mm.) drew the attention of the motoring world to the possibilities of the long stroke engine, although it was not until the new taxation system was introduced at the beginning of 1910 that long stroke engines—or more correctly engines with longer strokes than formerly prevailing—were introduced. The Four Inch Race for the 1908 Tourist Trophy will be remembered as the first big race won by an engine with a high stroke-bore ratio.

The race took place on September 25th, over a total distance of 337½ miles. Thirty-five cars started, and the first three places were secured by the following:

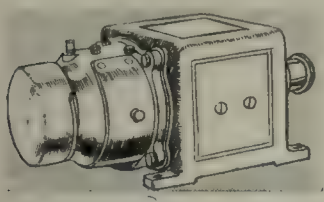
Driver and Car.	No. of Cylinders.	Bore and Stroke	No. of Speeds	Average Speed.
		mm.		m.p.h.
1. Watson, Hutton	4	102 × 177.8	4	50.25
2. Lee Guinness, Darracq	4	100 × 160	3	50.0
3. George, Darracq	4	100 × 160	3	49.6

Electric Car Lighting Systems.

An Alphabetically Arranged Description of the Principal Devices on the Market.

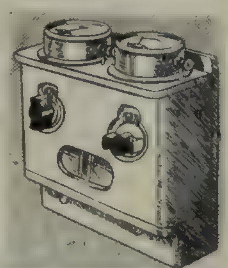
Bleriot.

IN this system a self-governing type of dynamo is used which is bipolar and compound wound, the windings being such that beyond a certain point any voltage increase is prevented, without the use of any such devices as slipping clutches or resistances. An automatic cut-out is, of course, used to disconnect the battery when the dynamo is unproductive. This is of the ordinary solenoid variety, and is encased within the switchboard, where its working is visible through a small glazed window. The illustration given herewith shows the design of the Blériot machine, which is very compact.



Blériot dynamo.

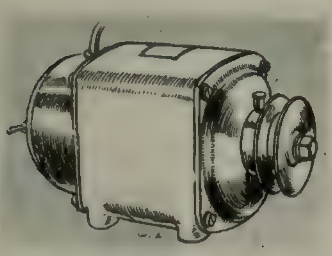
The second illustration shows the switchboard. This has its body of wood, upon the top of which are mounted an ampère meter and a volt meter, the former being capable of giving a reading of the battery charge upon pushing a small switch button, whilst the ampère meter shows the rate of discharge as well as the charge. Two rotary switches are employed to control the head, side, and tail lamps, whilst at the base of the board a couple of binding screws are attached so that an inspection lamp can be readily thrown into circuit. The Blériot dynamo is made in two sizes, having outputs respectively of 150 watts at eight volts and 200 watts at twelve volts. It is thus one of the largest installations of its kind. Sold by Blériot, Ltd., Blériot House, Long Acre, W.C.



The Blériot switchboard.

Brolt.

In this system a purely electrical means is employed automatically to control the dynamo, which is in essentials of the ordinary kind, and, with the exception of the minimum cut-out, there are no additional working parts whatever when the machine is in operation. In addition to the two ordinary wound poles of the carcase there are, at right angles to them, a pair of auxiliary unwound poles, which, however, in the case of the smaller sizes of Brolt dynamo simply consist of the side walls of the iron casing. The operation is, briefly, as follows: The current induced in the ordinary way in the armature exercises a cross-magnetising tendency which creates a magnetic flux in the auxiliary unwound poles provided to receive it. This flux is cut by certain armature coils, which are short-circuited by a wide brush for this purpose, and this short circuit current is in the opposite direction to the main current, and has the effect of demagnetising the main wound poles. The greater the output tends to become the more effectual is this counter-action, and, in consequence, the current controls itself and at or above a certain speed remains constant in volume and pressure. The dynamo is claimed to be quite sparkless in operation and to give a good output at a relatively low rate of speed, thus enabling it to work satisfactorily when geared only one and a half times faster than the engine, maximum current in these circumstances being generated at a car speed of 16-18 miles an hour, with an average gear ratio of about 4 to 1.



Brolt dynamo.

The minimum cut-out is simple in form, and is actuated electrically, having a perfectly positive action which is claimed to be quite immune from failure. This is contained inside the switchboard, which is of very neat design, and contains, in addition, a single dial reading the ampèrage of the charge current or the voltage of the battery, a rotary switch controlling the charge circuit and the various lamps. A plug adapter is provided for the inspection lamp, and a red telltale light which is switched automatically into action in the event of the tail lamp becoming deranged.

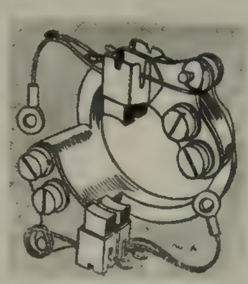
The Brolt sets are made in three sizes, viz., 45 watts, 6 volts; 90 watts, 12 volts; and 180 watts, 12 volts. Sold by Brown Bros., Ltd., Great Eastern Street, London, E.C.

C.A.V.

A special feature of the C.A.V. car lighting dynamo, and one that, in the opinion of many, is an exceptionally desirable one, is the complete absence of cutouts of any form; that is to say, with the exception of the self-contained dynamo itself, there are no working parts whatever, and the installation may therefore be justly described as the simplest possible. The principle upon which the dynamo is made to regulate its output is not such as to be readily understood by anyone who is not an advanced electrician. It will suffice to say that by means of cross-magnetisation of the armature the magnetic flux is caused to excite a couple of unwound poles which act in opposition to the two wound subsidiary fields, the result being a balanced effect between the two and a prevention of current increase beyond a certain maximum. The dynamo is self-contained, as shown in the accompanying sketch, a second sketch illustrating the neat construction of the brush gear, in which, it will be noticed, double carbons are used.

C.A.V. dynamo.

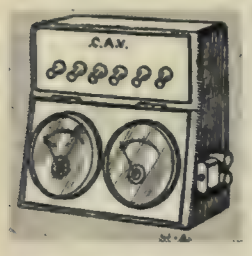
Instead of a minimum cut-out being employed to disconnect the dynamo from the batteries when the former is running at an unproductive speed or standing still, a very ingenious use is made of a simple free-wheel device in the driving pulley, and the battery can therefore run the dynamo as a motor without having to overcome the load of the engine, etc. Only the armature revolves, and this but slowly, and since it is



C.A.V brush gear.

mounted on ball bearings the consumption of current in these circumstances is exceedingly small and not enough to do the battery any harm at all. A charging switch enables this action to be discontinued when the car is standing still.

An especially good point is incorporated in the switchboard, of which an illustration is given, namely, that all loose joints and screws for the attachment of the internal connections have been done away with, and when once the board is assembled there is thus not the slightest possibility of any small part working loose by vibration, and so causing a derangement or a short circuit. In addition to the charging switch already mentioned, there are five others, all of the plain tumbler type, which control the head, side, and tail lamps respectively. Volt and ampère meters are fitted, and, in addition to the inspection lamp plug adapter, provision is made for immediately renewing, when necessary, a fuse which is inserted in the main field circuit to guard against damage to the dynamo in the event of its being run accidentally with the battery disconnected.

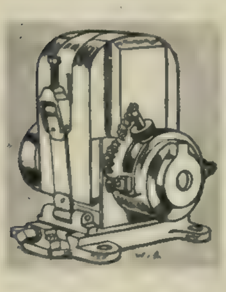


C.A.V. switchboard.

The C.A.V. installations, comprising a large variety of fittings, including lamps, electric horns, etc., are made in several sizes, viz., 45 watts, 60 watts, 90 watts, 100 watts, and 150 watts. Sold by C. A. Vandervell, Ltd., Warple Way, Acton, London, W.

Ducellier.

The Ducellier dynamo belongs to that class of machine in which the output of current generated is self-controlled and never rises above a certain definite maximum. In this particular case a simple but none the less ingenious and effective means is adopted to attain this end, and takes the form of an electro-magnetic field which is brought into opposition with the main exciting fields, the latter being produced by a number of horse-shoe permanent magnets arranged about the armature in a manner exactly similar to that of an ordinary magneto. The opposition field, which consists simply of an electro-magnet, is carried inside the tunnel of the magnets immediately over the armature, which is of the ordinary drum-wound type, and runs on ball bearings. The magnets are enclosed within a detachable aluminium cover (see appended sketch). The commutator is of the usual type, and discharges the current generated through a couple of carbon brushes to the battery. Between these two brushes is situated a third so mounted that its position relative to the field magnets is adjustable about the centre of the commutator. This third brush serves to deliver current to the opposing electro-magnet, and is made adjustable so that the output of the whole machine may be regulated to suit the consumption demands.


Ducellier dynamo.

The action is as follows: As the armature increases in speed an increased current tends to be generated, that is to say, there is a rise both in voltage and ampèrage, and this is actually the case so far as regards the permanent field magnets. As the current increases, however, the strength of the opposing field increases also, so that the total field is weakened exactly as much as the current is strengthened. In a word, the output remains perfectly constant as soon as a certain speed of revolution is attained. By altering the position of the third commutator brush the relative strength of the opposition magnetic field can be adjusted.

A glance at the sketch will show the neat arrangement of the dynamo, special attention being drawn to the sliding platform upon which it is mounted, the purpose of which is to allow the driving belt to be tensioned with the minimum of trouble and without fitting a new belt fastener.

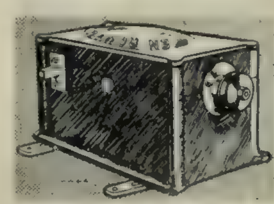
A minimum cut-out is used to prevent the possibility of the battery discharging through the dynamo, and takes the form of a magnetically operated switch, the whole being completely enclosed in a neat waterproof metal box. The output of the dynamo is 200 watts, the maximum revolutions being about 3,000. This output is sufficient to supply a full range of interior lights as well as the head, side, and tail lamps.

The switchboard, which is a case of polished wood, comprises volt and ampère meters and three throw-over switches for the head lamps, side lamps, and tail lamp respectively. There is also an adapter for an inspection lamp.

Sold by A. A. Godin, 1, Red Lion Square, Holborn, London, W.C.

En Route.

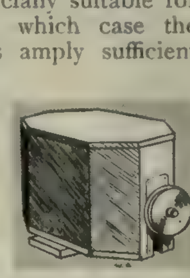
This set is quite small in size and output, and is therefore intended specially for use on small cars, its price being such as to appeal to small car owners. The illustration shows the general appearance of the dynamo, which is entirely encased in a waterproof case, so that it may easily be carried on the running board of the car. The aluminium lid of the casing is made to swivel and give access to the brush, gear, and commutator, but for the rest the case is sealed up. An electric cut-out switch of the usual type is employed to prevent the battery discharging through the dynamo.


The "En Route" dynamo.

Sold by the Motor Accessories Co., 55, Great Marlborough Street, London, W.

Lithanode.

Compared with most other self-generating sets, the Lithanode is relatively small, alike in size, weight, and output, and it is in consequence specially suitable for low and medium-powered cars, in which case the amount of illumination provided is amply sufficient for all ordinary purposes. The dynamo, which is, as shown in the accompanying sketch, entirely enclosed in a neat detachable casing, is of the simple shunt wound type and has an output of 10-12 ampères at a pressure of 4 volts. The removal of the casing, which is the work of a moment, exposes all the working parts of the generator to view.

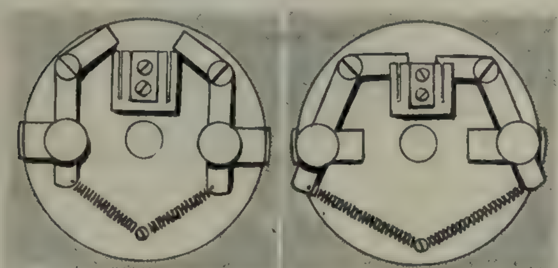

Lithanode dynamo.

The method adopted to regulate the current is exceedingly simple, reliable, and withal ingenious, and results in the charging current being maintained absolutely uniform and constant as soon as a predetermined maximum output is reached. The device

employed consists simply of a length of pure nickel wire, which has the property of providing a resistance practically proportional to its temperature. As the wire tends with increased output to become hotter and hotter, it simply dissipates the electrical energy in the form of heat, and suffers only a certain amount to pass to the battery of accumulators, between which and the dynamo the nickel resistance is arranged. The wires are supported, as shown in the sketch, on a bobbin, which is protected by a perforated metal cover.

Lithanode resistance.

The minimum cut-out, the function of which is to break connection between the battery and the dynamo at low and unproductive armature speeds, is worked upon a very neat mechanical principle, the action of which is simplicity itself. When the armature is at rest or revolving at a low speed, the two centrifugal governor balls are held by springs close up to the armature-shaft, and in this position the cranked arms upon which they are carried are out of contact with a fixed knife-switch device. As soon as the armature reaches a certain speed centrifugal action overcomes the tension of the springs, the balls fly outwards, and the connection is established. The principle and the general arrangement are clearly shown in the two diagrams, which represent the cut-out both open and closed.



Open. *Closed.*
Lithanode centrifugal minimum cut-out.

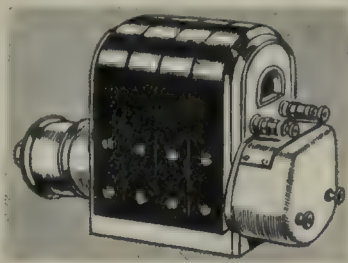
In conjunction with the Lithanode set, which also comprises a special range of head, side, and tail lamps, a neat and practical switchboard is used, comprising volt and ampère meters and tumbler switches for the charging control and for the various lamps.

It should be pointed out that the low voltage of this installation carries with it certain desirable advantages, one being that the lamp filaments are short and stubby, and consequently exceedingly strong and more likely to withstand vibration; another is that a couple of simple accumulators are all that are required for the storage battery, which is so small in size that a spare, fully charged, may easily be carried.

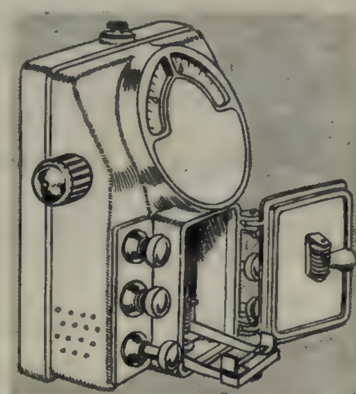
Sold by the Lithanode Co., 190, Queen's Road, Battersea, London, S.W.

Lodge.

The Lodge dynamo is strongly reminiscent, except, of course, that it is larger, of an ordinary high-tension magneto, the construction of which it follows closely, though having a drum-wound armature in place of one with primary and secondary windings. The field-magnets are of the permanent type, horse-shoe in shape. One incidental advantage of the permanent magnet system which may be pointed out is that the dynamo generates current equally well in either direction of rotation, and consequently no possible harm can be done to it if, for instance, the engine were in a forward gear and the car were to run backwards down a hill. No particular means are taken to regulate the current, which, however, owing to the strength of the field being constant, does not rise so rapidly as it would when there is, as in the case of the ordinary dynamo, an increase of field strength. As the batteries are always in circuit with the generator this output increase makes no difference to the lamps. A minimum cut-out is employed to disconnect the dynamo from the battery when the output of the latter is the greater, and this consists of an electro-magnetically operated switch contained inside the aluminium casing of the switchboard. A free wheel is also mounted on the armature-shaft as a further safeguard in case of the cut-out suffering some derangement.

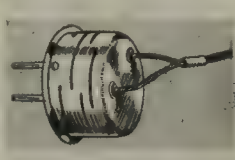


The Lodge dynamo.



Lodge switchboard.

The switchboard is worthy of special attention owing to its completeness, and an illustration is accordingly given of it. The head lamps, side lamps, and tail lamp are each separately controlled by a push-in plunger switch working like an organ stop. Between the two rows of switches is a hinged lid giving access to the automatic cut-out and also to the fuse which is introduced into the main generator circuit. Two meters show ampères and volts, the dials over which they work being very clearly marked and also being illuminated at night by a small electric lamp placed behind them. The switchboard also contains an electric buzzer, which, being in series with the tail lamp, immediately gives audible warning should the latter have its filament broken or a bad connection. To go with this switchboard Messrs. Lodge make a neat accessory in the form of a resistance plug which can be attached to the usual double peg adapter, and which enables a 4 volt ignition accumulator to be charged direct from the dynamo or from the lighting accumulator. It may be pointed out that the Lodge electric head lamps are fitted with Mangin lens mirrors in addition to parabolic reflectors, the glow lamps having closely bunched-up metal filaments.



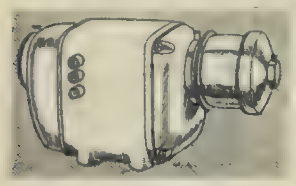
Lodge charging plug.

Sold by Lodge Bros. and Co., Wrentham Street, Birmingham.

Electric Car Lighting Systems.

Lucas.

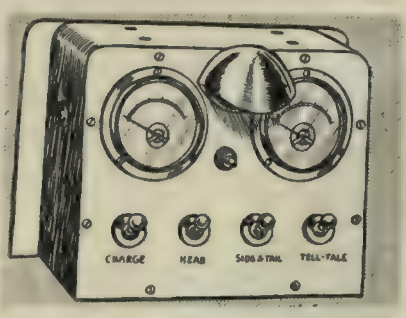
The Lucas dynamo, of which a perspective sketch is given, is characterised by the strictly mechanical method by which the output is prevented from rising above a certain maximum, and so overcharging the storage batteries. The generator is quite a simple one of the shunt wound type, the shunt connection being broken when the accumulators are not being charged, so that in these circumstances the armature runs perfectly free in its ball bearings. All parts are enclosed, and therefore practically weatherproof.



Lucas dynamo.

The mechanical device referred to consists of a special form of clutch which serves to connect the driving belt pulley to the armature-shaft, the former being carried loosely on the latter. The clutch is of the cone type, its frictional surfaces being hard fibre to metal. The cones are normally held together by a strong spring. The withdrawal of the clutch is accomplished quite automatically by means of a centrifugal governor which comes into play when a certain pre-determined armature speed is attained. Since the governor is connected to the armature-shaft it follows that the latter can never exceed this definite speed, and consequently the output of current is limited. All the components of the clutch are enclosed in an oil-proof case, the whole affair being, as indicated in the sketch, quite small. Since the slipping surfaces of the clutch are well lubricated, practically no wear can take place.

The Lucas switchboard is a very neat accessory, and, in addition to carrying an ammeter and a voltmeter—the latter being connected up to the battery, when desired, by pushing a small button switch — also serves to house the magnetic cut-out, which serves to disconnect the battery from the dynamo when the latter is giving its output at an insufficient pressure for charging. If this were not done the battery would, of course, discharge itself through the dynamo in tending to run it as a motor. At the top of the switchboard is a small lamp with a polished metal cowl, whilst at the side a double-peg plug adapter is fitted so that, when necessary, an inspection lamp can be connected up. The lamps are controlled by four tumbler switches, one for the head lamps, one for the side and tail, and one for a tell-tale lamp in circuit with the last-named. A fourth switch serves to disconnect the dynamo from the battery when charging is not required.



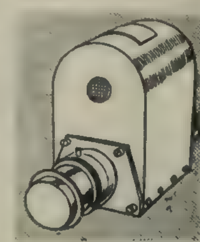
Lucas switchboard.

The Lucas accumulators, which are specially made for use with the dynamo lighting set, are furnished with cylindrical plates insulated from one another by porous pots. Buckling of the plates under a high discharge is therefore rendered impossible, and, at the same time, no amount of vibration, it is claimed, can cause the paste to dislodge itself from the grids.

The Lucas electric lighting sets, which are made in two sizes, viz., 100 watts and 200 watts, are sold by Joseph Lucas, Ltd., Birmingham.

The Mira Magnetolite.

This is one of the simplest types of machine as well as, it is interesting to note, one of the earliest of the self-contained car-lighting dynamos. It is of the permanent magnet type, the fields consisting of twelve horse-shoe magnets arranged in four rows of three each. An entirely automatic and satisfactory means is relied upon to prevent an undue rise of current when the armature speed is high, and consists in merely taking advantage of the fact that the magnetisation which develops in the armature is in opposition to the magnetisation of the fields. Consequently, whilst the current tends to rise on account of a great number of lines of force being cut in unit time, the demagnetisation effect as above tends to counteract such rise. It must be, however, pointed out that this reaction in no way affects the permanency of the magnets, whereof the useful life is indefinitely long. The armature rotates on ball bearings, and is of the drum wound type with eight poles.



Mira Magnetolite.

A mechanical device performs the function of a minimum cut-out in severing the connection between battery and generator when the current produced by the latter is insufficient to charge the former, and takes the form of a simple contact breaker carried inside the body of the driving pulley. A diagrammatic sketch of this contrivance is given. A curved flat spring normally holds the two contacts apart, but at a certain speed centrifugal force, acting in antagonism to the spring, causes a bob-weight attached to the loose contact screw to fly outwards, the circuit being closed thereby. A point in connection with generators of the permanent magnet type which is worth prominence is that, by reason of the fact that the fields do not have to be previously excited by armature reaction, a good pressure of current can be produced at a very low rate of speed, and, in consequence, wear and tear can be reduced to a minimum.

Magnetolite cut-out.

In conjunction with the Magnetolite set, a convenient and handsome switchboard is made, and comprises quick action push-in switches (working on the see-saw principle) and a voltmeter and ammeter which are continually in circuit with the dynamo, the ammeter showing both charge and discharge.

Both the dynamo and switchboard are made in two qualities, standard and *de luxe*.

Sold by Charles Jarrott and Letts, Ltd., 45, Great Marlborough Street, London, W.

The Magician.

In this machine a very ingenious and simple means is provided whereby the current regulates itself and maintains a certain desired constancy, without requiring any complicated mechanism or electrical means.

When the armature of any dynamo is rotated, the mechanical reaction between the armature and field magnets results in the carcase of the dynamo having a tendency to rotate with the armature, which, of course, is resisted by permanently fixing the dynamo frame to some part of the car. In the U.M.I.

The Iconoclast.

¶ The Victor Tyre is the iconoclast—the idol breaker. Motor tyres have, hitherto, lived upon sentiment—and advertisement. The sentiment for old age is, within limits, a very desirable thing. It is natural and ingrained. The old tyre firms have exploited it by the sweet uses of advertisement. It has been left to the Victor to demonstrate that there is no virtue in whiskers on a motor car tyre. Hence Victor—the iconoclast.

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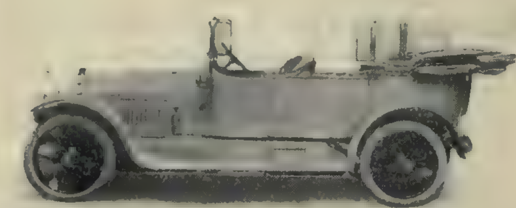
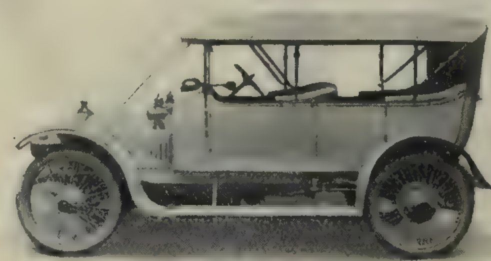


Cann boat body on 38 h.p. Minerva chassis built for New Zealand.



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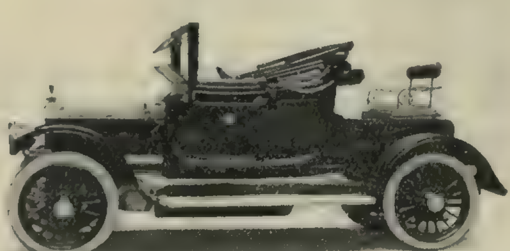

Medicann body on 38 h.p. 4-cylinder Daimler chassis (head down).
Built for H.H. the Ameer of Afghanistan.
To the order of the Bombay Motor Company.

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To the order of the Bombay Motor Company.

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Warland dual rims and spare rim fitted with Dunlop grooved tyre and tube.

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Large horn and flexible tube, number plates, tyre-repairing outfit, tyre, pump, tool kit, jacks.

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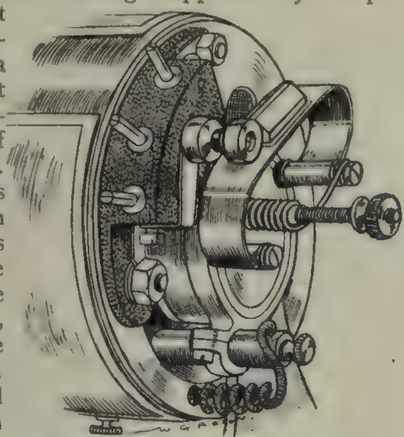
Magician machine the carcase is not so rigidly fixed, but it is hung on two bearings supported by a separate bed-plate. It is held in its normal position by a spring, against which the rotating tendency of the carcase works. The field magnets and the two main collecting brushes are fixed to the carcase, in the ordinary manner, and therefore move with it. But the third brush, which draws off the current for the excitation of the fields, is attached to the fixed bed-plate. At low speed the dynamo behaves in the same way as the ordinary commercial type, but as the speed is increased the tendency of the carcase to rotate gradually overcomes the spring, and consequently the carcase adopts a fresh position, relative to the armature. This being the case, the field excitation brush supplies less current than formerly, so that when the increase in speed takes place, the density of the field automatically becomes less, and therefore the output remains constant. This action, of course, continues almost indefinitely, as the carcase has good enough range of movement to put the exciting brush almost into the neutral position, and in this manner an infinite number of r.p.m. is provided for. There is, therefore, no chance of over-running the device.



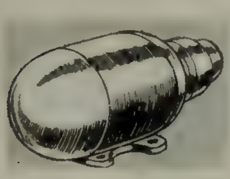
The automatic cut-out and fixed brush of the U.M.I. Magician dynamo; the coil spring resists the rotation of the dynamo body.

The minimum cut-out is neatly incorporated in the mechanism above-mentioned. One terminal is carried on the dynamo carcase, and the other on the fixed bedplate, so that the circuit between the dynamo and battery is not closed until the carcase has moved forward to a certain amount.

Sold by United Motor Industries, Ltd., 46, Poland Street, London, W.

Peto and Radford.

A simple shunt wound ironclad type of dynamo is used in the P. and R. electric car lighting set, and its form is shown in the illustration. The means adopted to regulate the current comprises a mechanical device which automatically prevents the armature-shaft from being driven at a speed higher than a pre-determined maximum. This consists of a slipping clutch mechanism controlled by a neatly arranged and totally enclosed centrifugal governor which operates a pair of balanced friction surfaces so devised that under no circumstances is there any end thrust upon the armature spindle bearings, which are, of course, of the ball variety. The minimum cut-out takes the form of an electro-magnetic switch working on the differential principle and ensuring a connection between the battery and the dynamo immediately the output of the latter reaches a pressure in excess of the battery charge. A special positive clutch is also made so that during daytime, when the dynamo is not required to work, it can be thrown out of operation altogether.



P. and R. dynamo.

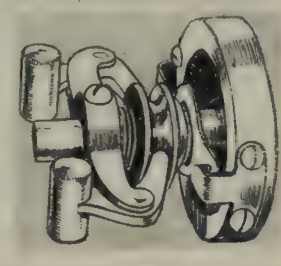
An alternative method of driving the P. and R. dynamo is by means of a friction wheel which is held in contact with the engine flywheel by a spring. This friction wheel being suitably bevelled, it is caused to have, when required, an axial movement produced by a centrifugal governor; it is therefore taken out of contact with the flywheel, and, as a consequence, a constant maximum armature speed is assured.

The P. and R. switchboards are made in metal casings, and comprise all the usual fittings.

Sold by Peto and Radford, Ltd., 100, Hatton Garden, London, E.C.

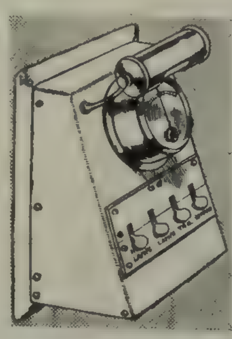
Polkey-Jarrott.

The dynamo used with this set is also of the type in which the output is self-regulating, and this is accomplished by subsidiary brushes in conjunction with shunt windings of the fields, employing the principle of flux distortion when with increasing speed the armature itself becomes magnetised. An interesting point in this generator is the automatic cut-out which controls the point at which the dynamo is switched into connection with the battery. This cut-out works upon the mechanical principle, and is, as shown in the accompanying sketch, very simple in construction. It consists of a small centrifugal governor, mounted on the end of the armature-shaft opposite to that on which the driving pulley is carried. When a certain pre-determined speed is attained the governor balls fly outwards and close the circuit by means of two spring contact pieces which are carried on a fibre disc. After making contact in this manner, the switch blades are held firmer and firmer together, so that there is no possible chance of a bad contact existing at this point. The dynamo itself is neatly enclosed, the brass extension of the casing serving entirely to cover in the cut-out.



Polkey-Jarrott automatic cut-out.

The switchboard, of which an illustration is given, is furnished with a deadbeat ampère meter showing charge and discharge, below which are four tumbler switches controlling respectively the charging connection, side lamps, head lamps, and tail lamp.



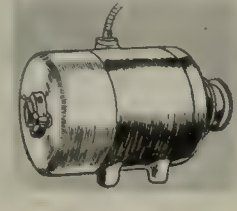
The Polkey switchboard.

Sold by George Polkey, Ltd., Pitsford Street, Birmingham.

Rotax.

The Rotax-Leitner dynamo was one of the earliest placed upon the market for car lighting use, having an automatic means for the regulation of the current. This is accomplished quite automatically by means of a patented arrangement of brushes, the working being briefly as follows:

The dynamo is of the ordinary two pole type with ball bearing drum wound armature. In addition to the main



Rotax dynamo.

Electric Car Lighting Systems.

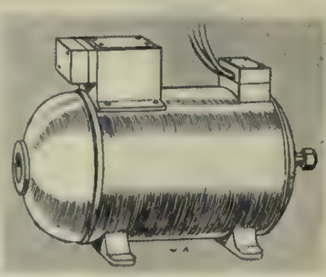
brushes there are two subsidiary brushes placed at an angle of about 60° in front of the former. These brushes are connected to simple shunt field windings round the electro-magnets. At a low speed of armature rotation the subsidiary brushes collect current in exactly the same manner as the main brushes, and consequently increase the density of the field. In this manner a fairly large output is available at comparatively low armature speeds. As the speed is increased the armature flux begins to distort the field flux in the direction of the rotation, and the effect of this is to reduce the potential of the subsidiary brushes, so that in these circumstances the magnetic field is reduced in strength. The effect, however, does not end here, but is continued with increased armature speed until the current flowing through the shunt windings is nothing at all. Beyond this point it changes its sign, and from being previously positive, now becomes negative, thus at very high armature speed the shunt winding of the field opposes the main winding. The output therefore remains perfectly constant. The Rotax dynamo, which is a very neatly arranged machine, is shown in the illustration. The second sketch depicts the switchboard used in conjunction therewith. It has two meters for showing volts and ampères respectively, and a single semi-rotary switch for controlling all the lamps. It is made in one size only—150 watts at 12 volts.

The Rotax switchboard.

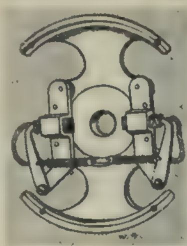
Sold by the Rotax Motor Accessories Co., 43, Great Eastern Street, London, E.C.

Rushmore.

In this system a very ingenious method of regulating the current is adopted. The dynamo, a sketch of which is given beneath, is of the simple ironclad bipolar type, in which all parts are enclosed, the armature running on ball bearings. The brushes and commutator run without sparking, so that practically no attention beyond a little occasional lubrication is demanded by the generator. An electro-magnetically operated cut-out serves to sever the connection between the dynamo and the storage batteries when the output of the former is insufficient to charge the latter. In addition to the ordinary self-exciting field magnet windings there is an opposition winding which is known as a "bucking coil." This coil, the effect of which is to weaken the field excitation, is connected as a shunt across an iron wire "ballast" coil. In order to explain the reason for this device being employed it is necessary to point out that iron wire possesses the peculiar property of increasing greatly in electrical resistance at a certain critical temperature just below red heat. Below this temperature the resistance is practically constant, but above it the resistance increases enormously with every degree of temperature increase. The ballast coil is connected between the dynamo and the battery in such a manner that the current generated has two paths open to it, to pass through the bucking coil or through the iron wire coil. The resistance of the latter is considerably less, when it is cold or only warm, than that of the bucking coil, and it consequently allows, at low speeds, all the output to pass to the batteries. As the armature speed is increased the output tends to rise, and in carrying the enhanced current the ballast coil becomes hotter and hotter until its resistance is greater than that of the bucking coil. The current is thus partially diverted into the latter, with the result that the field excitation is decreased and the output drops almost exactly as much as it tends to rise, provided that the various components be suitably proportioned.



Rushmore dynamo.



Rushmore brush gear.

It will thus be seen that in the Rushmore dynamo the voltage, which is immediately dependent upon that of the battery, has no tendency whatever to rise. The ampèrage rises steadily until the ballast coil becomes red hot, and then remains constant no matter how much armature speed is increased. The smaller sketches illustrate the Rushmore brush gear and the arrangement of the ballast coil, which is wound upon an insulating heat-proof bobbin and is carried in the switchboard. The latter is simplicity itself, and comprises an exceedingly desirable feature, namely, that except when the minimum cut-out comes into operation at low speeds the dynamo is always charging the accumulators. In daylight, or, rather, until the head lamps are switched on, the ballast coil is out of action, and consequently the generator runs as a simple differential dynamo, its current being cut down by the counter field excitation to about 3-4 ampères, which provides a steady "soaking" current sufficient to light the tail and side lamps and to keep the battery fully charged when these are not in use. The wiring is so arranged that the act of switching on the head lights also throws the ballast coil into parallel with the bucking coil, thus automatically increasing the dynamo output whilst the head lamps are in operation.

Rushmore ballast coil.

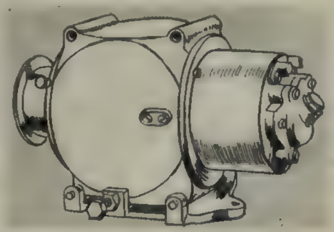
The Rushmore set is made in two sizes, viz., 100 watts (15 ampères at 6½ volts) and 150 watts (25 ampères at 6½ volts). The low voltage used is in this case specially advantageous, as it enables the short filaments of the glow lamps to be closely bunched up together, and as the light consequently comes from what is approximately a point, a very fine optical effect is obtained.

Sold by Rushmore Lamps, Ltd., 46, Brewer Street, Piccadilly Circus, London, W.

Trier and Martin.

A most ingenious principle, which results not only in the automatic regulation of output but brings along other advantages besides, is made use of in the Trier and Martin system, the working of which is as follows: The dynamo is of the plain bi-polar type employing a ring wound armature. Two main brushes collect the current and excite the electro-magnetic fields in the ordinary way, but in addition to them there are two subsidiary brushes situated at about 90° from the main ones. One main brush is connected to one subsidiary brush *via* a resistance coil, the current between the brushes flowing in the same direction as

the direction of rotation of the armature. The effect of this current when the dynamo is running normally is to increase the magnetisation of the fields. As, however, the load increases an armature reaction is set up, which, so to speak, tends to carry the magnetic flux forward with the armature. This reduces the difference of potential between the main and subsidiary brushes, with the result that the magnetic field becomes weakened. Further displacement of the flux beyond a certain point reduces this potential to zero, and finally alters its sign, *i.e.*, it becomes negative instead of positive and still further weakens the main field. As this weakening tendency is opposed to the effect of increased speed of armature revolution, the current remains constant. A great advantage of this system is that, by suitably designing it, the subsidiary brushes can be brought to a state of idleness during normal working, and consequently there are no electrical losses; at the same time, certain of the armature coils also remain idle. The effect of this is that for a given output a smaller armature can be used than would otherwise be the case, and the whole dynamo can be correspondingly reduced.



The T. and M. generator.

The minimum cut-out which is employed is not only effective but highly ingenious. A small flywheel carried on the armature-shaft runs partially submerged in a shallow bath of mercury. As the speed of the armature increases the wheel tends to throw the mercury further and further tangentially up the side of the bath, until it eventually touches a small contact piece, establishes a perfect electrical connection and so closes the circuit between the battery and the dynamo.

A sketch of the generator is given, and shows the platform upon which it is carried: this is furnished with a very simple means whereby the tension of the driving belt can be adjusted.

A characteristic feature of the neatly-designed switchboard which is made to go with the T. and M. set is that the operation of the various switches which control the head lamps, tail lamp, etc., introduces into the main circuit various definite resistances which ensure that the charge from the dynamo is at all times just sufficiently in excess of the consumption of current by the lamps. The accumulators are thus furnished with a steady "soaking" current which keeps them in the best possible condition. The switches are all actuated by a single rotary controller giving a series of positive movements, its position at any time being indicated by a number visible through a small circular window.

The T. and M. installation is made in two sizes, viz., 100 watts at 8 volts and 150 watts at 12 volts. Sold by Trier and Martin, Ltd., 115, Great Portland Street, London, W. W.G.A.

A Modern Landaulet.

Present day practice of making open bodies flush-sided and torpedo-shaped has spread to enclosed cars. The above illustration shows how this effect is obtained on a landaulet, also the merging of the bonnet into the dashboard. Note also the gradual slope of the top at either end—this is a feature of modern covered-in cars and one that undoubtedly enhances their appearance. The chassis of the landaulet illustrated is a six-cylinder Vulcan

Self Starters.

The Principal Systems Described.

THE fitting of self-starting devices to cars on any scale commenced in America some two or more years ago; the last Olympia Show was the first occasion on which British manufacturers showed them in any numbers, although one or two cars on the British market—such as the S.C.A.T.—have been turned out with self-starters for several years. At present an increasingly large number of cars on the American market include self-starting arrangements as standard fittings. The reasons for their cult by American manufacturers are not far to seek. The big high-powered unrefined engines, together with the severe winters, make mechanical self-starters in America almost a necessity, whereas in England they are, with certain exceptions, luxuries. For the use of medical men and others constantly stopping and starting a self-starting device is a great asset even on low-powered four-cylinder cars, and also for ladies driving without a chauffeur the same applies.

Acetylene. (Bell.)

This form of automatic starter is a development of "starting on the switch." There are four separate pumps, one for each cylinder, all adapted, when the

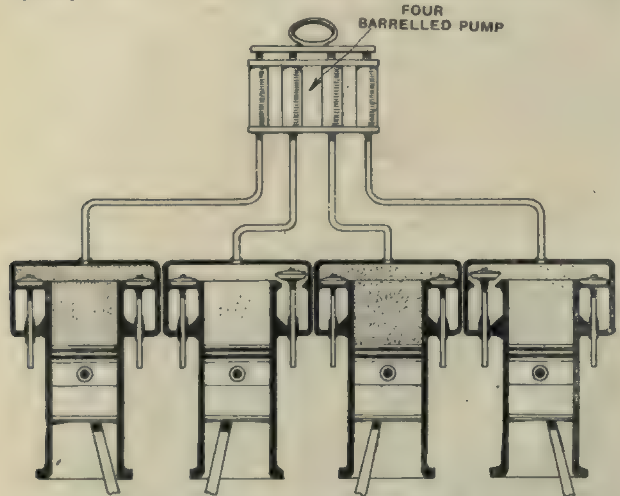


Fig. 1.—Diagram of engine with acetylene self-starter.

pump handle is pulled out, to fill with acetylene simultaneously. On pushing in the pump handle this acetylene is pumped into all four cylinders. In two cylinders both engine valves are closed, whilst there are always two in which the opposite is the case, having in the one case an inlet, and in the other case an exhaust valve open. Hence in two cylinders the acetylene is under pressure, whilst in the one case it fills the cylinder and inlet pipe, in the other scavenges the cylinder and exhaust pipe. On switching on the accumulator current, explosions take place in three cylinders in succession, by which time the carburetter operates in the ordinary way.

This type of self-starter is not fitted at the time of writing to any British car, although one or two of the American cars represented in England are so provided.

Pneuo-mechanical. (Enfield.)

The Enfield is an air starter in which the dead centre difficulty has been overcome.

In this device there is a small compressor driven from the crankshaft at the forward end of the engine, and this charges a tank to a pressure of about 150 lbs. per square inch, this being the maximum possible under any circumstances, as the clearance at the end of the air-cooled pump cylinder limits the range over which air can be pumped.

Instead, however, of leading the air from the storage tank to the main engine cylinders through a distributer and a special valve gear, the engine is revolved through the medium of a toothed wheel mounted on a stout free-wheel on the shaft which joins the clutch to the gear box. Mounted across the frame, of which it practically forms a part, is the apparatus shown in the diagram below. Here A is a cylinder containing a long piston B, on the trunk of which a rack is cut. If now air be admitted to the space C the piston will be driven to the left, the rack will cause the gear pinions to revolve, and this in turn will spin the engine, the free-wheel allowing the crankshaft to run on directly the first explosion takes place. Actually the piston normally is further to the right than shown, so that the end of the rack clears the pinion, and then, of course, even the free-wheel is not in use, the pinion merely revolving loosely. The first operation is to depress a small pedal which sets the admission valve D, and then a tap on the dashboard is turned admitting air at E. The piston now travels down its stroke, and, near the end, the striker F touches a collar on the valve rod G, so moving the valve, allowing the used air to escape, and admitting more air through the pipe H to the inside J of the main piston. As the pipe H ends in a kind of piston this action causes the main piston to be blown back into place ready for the next start.

Naturally the capacity of the storage tank is sufficient to enable many starts to be made on one charge of air, although, in an ordinary way, one operation is enough. The pressure of the air is great enough to spin the engine sharply, and if a backfire should

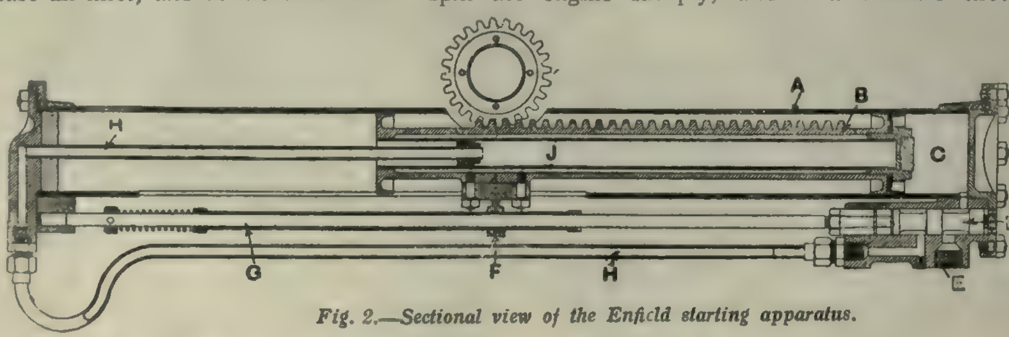


Fig. 2.—Sectional view of the Enfield starting apparatus.

A. Cylinder.
B. Piston.
C. Air space.
D. Admission valve.
E. Air inlet port.
F. Striker in valve rod
G. Valve rod.
H. Air pipe to return side of piston.
J. Air space on return side of piston.

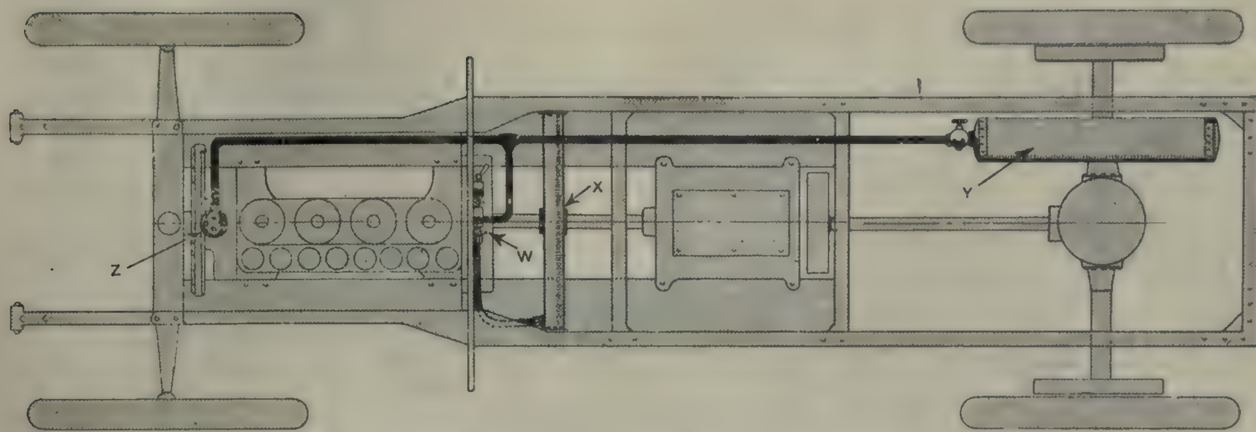


Fig. 3.—Diagram showing the arrangement of the Enfield self-starter.
W. Starting valve on dashboard. X. Starter. Y. Air reservoir. Z. Air compressor.

happen the only effect would be to drive the starter piston back against its air cushion and no harm would be done.

Air Engine. (Sunbeam.)

Referring to fig. 5, it will be seen that an air compressor M is fitted with the lid of the gear box L as a base, the gear wheel on the air compressor shaft engaging with one of the gear wheels of the gear box. The air compressor is not always in action, but its pinion is moved into mesh by the operation of the rod R. An air tank is, of course, provided for the storage of the compressed air.

Referring to fig. 4, the valve side of the air engine is seen on the near side of the main engine, and consists of three cylinders B, six poppet valves C and D, operated by the usual form of camshaft, the exhaust air being delivered direct into the bonnet space.

It will be seen that a screw valve F is provided, and also a pressure gauge G, the operation of this

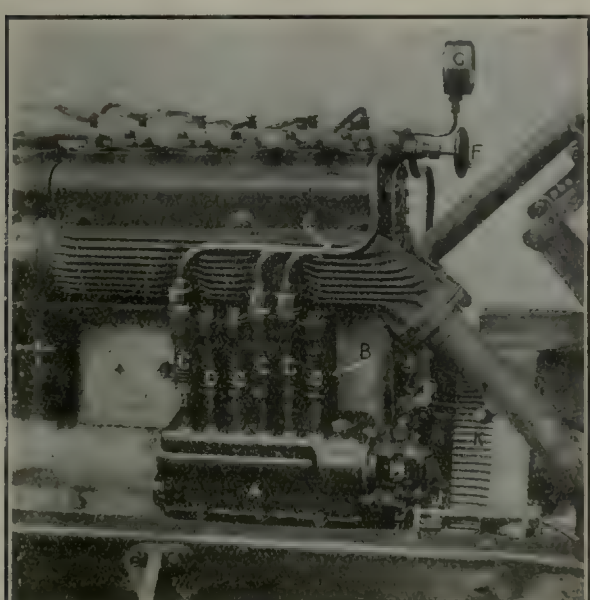


Fig. 4.—The air engine of the Sunbeam engine starting system. This air engine is, as shown, secured to the near side of the main engine crank chamber, and by moving the pinion J into engagement with the teeth K on the flywheel the air engine and the main engine are coupled up.

A. Crank chamber of air engine.
B. Rear cylinder of air engine.
C. Inlet valves.
D Exhaust valves.
E. Air inlet pipe.
F. Air valve.
G. Gauge.
H. Driving roller chain.
J. Sliding pinion.
K. Gear teeth on flywheel.

screw valve from the driver's seat admitting air to the cylinders of the air engine by way of the air inlet pipe E. The power from the air engine is transmitted to the flywheel of the main engine through a roller chain

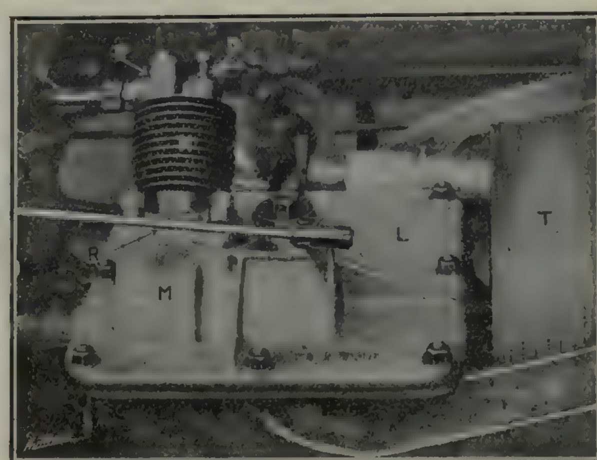


Fig. 5.—The air compressor of the Sunbeam engine starting equipment. The crank case of the compressor is formed in one with the lid of the gear box.

L. Lid of gear box.
M. Crank chamber of air compressor.
N. Cylinder of air compressor.
O. Automatic air inlet valve.
P. Air exit valve.
R. Rod engaging driving pinion of air compressor
S. Air pipe leading to reservoir.
T. Brak drum on front end of pro peller-shaft.

H and sliding pinion J. To start the engine, therefore, the sliding pinion J is moved into mesh with teeth K cut on the outer periphery of the flywheel. The air valve on the dashboard is then opened and air is admitted to the air engine, which, capable of developing 7 h.p., then easily rotates the main engine at quite a high speed. It must be distinctly borne in mind that the compressed air is not admitted to the cylinders of the main engine, which works entirely under normal conditions when rotated by the air engine, in the same way as if it were rotated by hand, except that it is turned at a very much higher speed. It will be realised that there is no necessity for valves in the cylinder heads nor for a distributing valve, such as are required with the usual type of atmospheric starter. When the car is running under normal conditions none of the air starting parts are in motion, both air compressor and air engine being then disengaged from their drive.

It should be added that the Sunbeam Company are only fitting this device to their 25-30 h.p. six-cylinder model.

Self-starters.

Compressed Air with Distributer. (Wolseley.)

A distinctive feature of the Wolseley self-starter and automatic tyre inflator is that it has been designed to fit the 24-30 h.p. six-cylinder Wolseley chassis, and is an integral part of it. It is the result of over a year's patient experimental work, and can be relied upon as a thoroughly tried and proved addition to the chassis.

It consists of five essential parts: an air compressor, an air reservoir, a distributer, a main valve and junction box, and the necessary control on the dashboard. The air compressor is a neat two-cylinder pump bolted on to the gear box and equal to giving a pressure of 300 lbs. in the reservoir, which takes the form of a steel bottle, or cylinder, hung from the frame on the opposite side to the silencer, and is of about the same size, though placed somewhat further back. The compressor has automatic inlet and exit poppet valves, and is driven through a jaw clutch by an

Two levers on the dashboard give all the necessary control; one throws the air pump in or out of action, while the other starts the engine by admitting air to the distributer, and also throws the tappet levers of the distributer cams into position between the cams and valve stems. Having once pumped up pressure in the reservoir all one has to do to start the engine is to open the throttle, switch on, and then move the starting lever.

When not actually starting the engine the tappet levers are moved clear of the starting valve stems, and are also held clear of the starting cams by the single motion of "turning off" the starting tap. To inflate a tyre a separate tap is provided close to the main junction box and projecting from the side of the chassis on the left. After screwing on the flexible pipe to the air valve and to the tyre valve, all one has to do is to open the tap gently and the tyre is quickly inflated to the required pressure. By the

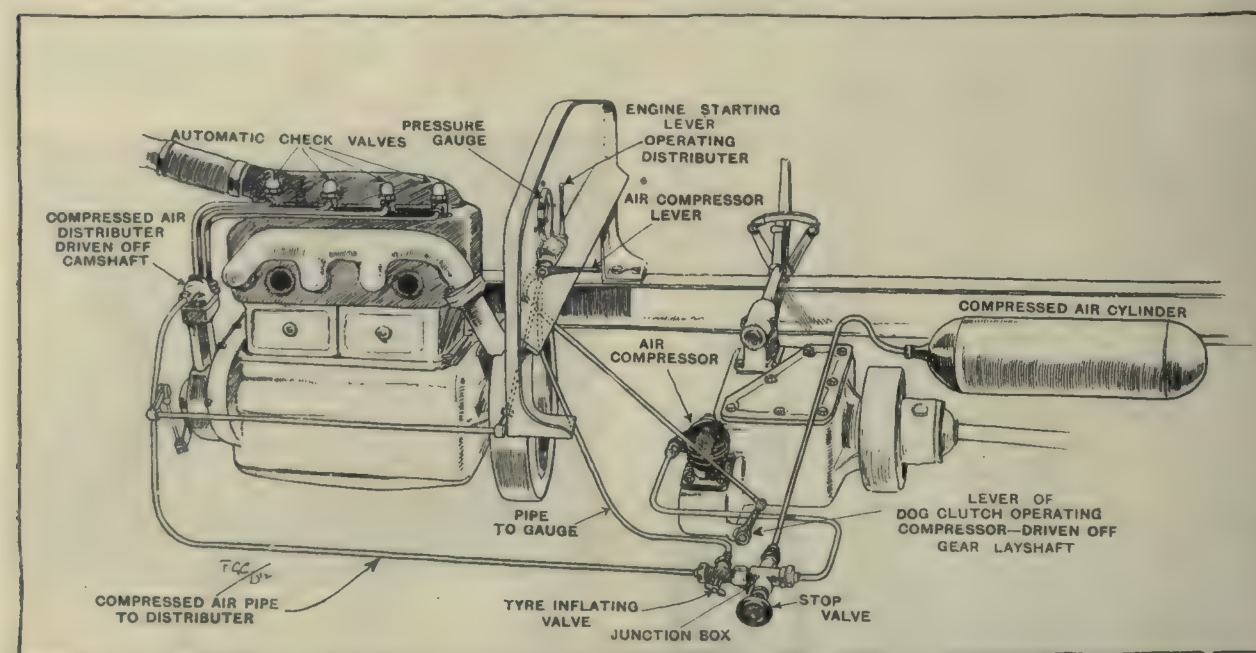


Fig. 6.—The general arrangement of the Wolseley compressed air starting system shown diagrammatically.

enclosed silent chain off the forward end of the gear-box layshaft, while its lubrication is entirely automatic, being provided from the gear box oil. A great point about the device is that it is so arranged that when the compressor is out of action there is no extra running part, as the dog clutch is on the driving pulley of the chain, so that when the pump is thrown out of action there is no additional friction or needless wear. We are told that approximately ten miles is sufficient to charge the air reservoir fully, and that when fully charged it contains sufficient air to start the engine about thirty times. The air distributer, enabling the air to be served to the four cylinders in proper sequence, is placed in front of the engine and driven by the camshaft. The distributer, like the air pump itself, is so arranged that when not actually starting the engine no parts are in motion. Steel pipes lead from the distributer to each cylinder of the engine, air entering through the centre of the exhaust valve cap. Small automatic check valves are provided in each valve cap junction, so that there is no leakage of pressure backward into the distributer either when starting the engine or when it is working in the ordinary way.

side of the tyre inflating valve is the main or master air tap which is shut when the car is out of use, so that there is no possibility of the compressed air stored in the reservoir leaking away. The joints of all the pipes for the air service are of a special sort which Messrs. Vickers have used for submarine work and for far higher pressures than occur in the Wolseley self-starting system.

Mechanical Spring Actuated. (Ever-ready.)

In outward appearance the Ever-ready engine starter resembles nothing more than a reversed conical head light placed at the position of the starting handle, where it is attached to the member of the frame which passes beneath the radiator. Described in general terms, the Ever-ready starter consists of two powerful flat coiled springs E attached to a central shaft at one end and anchored to the casing A at the other. The shaft to which the inner ends of the springs are attached connects to the crankshaft by an intermediate shaft C, with a universal joint at each end. When the engine is originally started the springs are wound up by the motor for twenty-six revolutions, at which point the winding mechanism automatically dis-

engages itself, leaving the springs in a coiled state or wound up ready to start the engine. The springs are retained in the coiled position by a brake band F, which, when it is required to start the engine, is released through a release lever D by the depression of a plunger pedal projecting through the footboard in a convenient position. The springs when so released uncoil in such wise that the apparatus will, it is claimed, rotate the engine for eight revolutions at a speed of 300 r.p.m. So soon as the engine starts the pedal is released and the springs are promptly rewound for the next start whenever it may be required.

It is claimed that the Ever-ready self-starter will start on the magneto any engine that can be started by hand on accumulator ignition. Should starting not result from defective ignition or fuel feed, the starter can be wound up by hand by means of a handle supplied for the purpose, or by slipping a sleeve over the handle, also supplied for the purpose, the engine can be turned over in the usual way. In order to render the rewinding of the springs an absolutely easy job, these springs are recoiled by means of a train of reducing gears B.

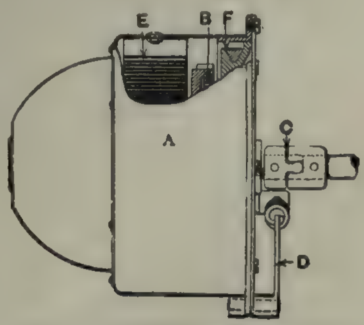


Fig. 7.—The Ever-ready mechanical self-starter.

A. Casing.
B. Reduction gear.
C. Coupling with crank shaft.
D. Spring release lever
E. Flat coil springs.
F. Brake band.

Electric. (Lanchester.)

The electric self-starter adopted by the Lanchester Co. is the Delco system, which, it is claimed, will run the engine for fifteen minutes or more, if necessary. It will start the engine in any position, whether the cranks be on dead centre or not, and also forms the principal component of an electric lighting installation.

The equipment consists of a dynamotor, a set of accumulators, a control switch and meter, a starting lever, and a train of reduction gears between the dynamotor or generator and the engine flywheel. The dynamotor is mounted on a bracket on the brake casing, and is driven off the transmission-shaft by means of a silent chain totally enclosed in a chain case and lubricated automatically.

The small pinion on the front end of the driving-shaft engages with teeth cut on the periphery of the flywheel when it is desired to start the engine.

A lever is arranged immediately to the left of the driver's seat which controls simultaneously the gear train, which is of the sliding type, and the control switch which connects the accumulators in series to the dynamotor. After switching on the ordinary magneto ignition, turning on the petrol, and opening the throttle slightly, a start is effected by holding the starting lever forward until the engine commences to run, when the pressure should be released. A spring is provided which at once returns the lever and disengages the starting gears, and also returns the switch to its normal position in which the accumulators are coupled in parallel for charging and lighting. Having effected a start, the car when in motion drives the electric motor, which then functions as a generator, charging the accumulators.

The dynamotor or generator is designed to supply the electric current to the system at a pressure of eight volts, or slightly in excess of this pressure, in order to charge the accumulators. The accumulators are designed to store up electric current and give it off again at a pressure of eight volts.

The generator is so constituted as to supply about ten ampères to the battery or main line, when running at 750 revolutions per minute (about twenty-one miles per hour with normal gear), but at low speeds the electrical pressure or voltage is not equal to that of the accumulators, so a device called the cut-out relay is provided to prevent the backward flow or discharge of current.

The relay is designed to close the main line circuit when the voltage of the generator is equal to that of the battery, and to open the circuit when the generator slows down and the voltage drops below that of the battery.

The generator being direct driven from the transmission-shaft is, of course, driven at varying speeds, and therefore the amount of current supplied varies

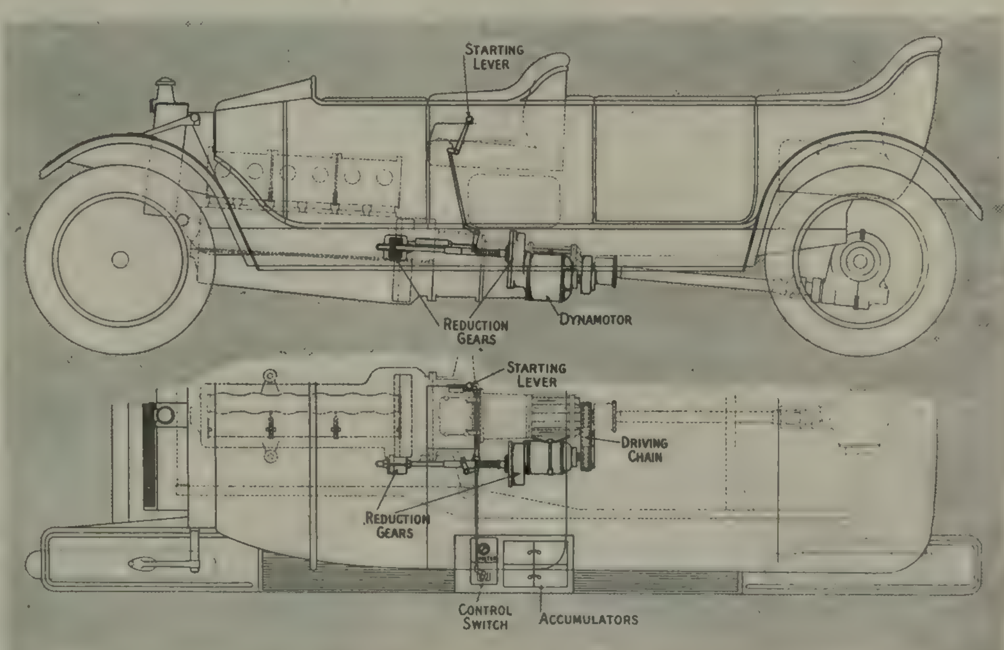


Fig. 8.—Two views of a Lanchester car, showing the disposition of the components of the electric starting and lighting equipment.

Self-starters.

accordingly, and a means must be provided to regulate this when the accumulators become fully charged. For instance, the machine may be operated during the day when no current is required for lighting, and the only demand on the system is the current necessary for the occasional engine starting. Driven at normal speeds, the current generated will be in excess of the amount consumed, and the surplus will be passed into the accumulators until they are fully charged, when the generator is caused to reduce its output to the necessary extent.

The device which regulates the amount of current put into the accumulators is an ampère hour meter, which is introduced in the main circuit of the generator and measures the amount of current put into and taken out of the accumulators. This meter is arranged to admit to the accumulators an amount of current slightly in excess of their actual capacity, and then to stop the operation of the generator or reduce its charging rate, according to the demand upon the system.

Current flowing into the accumulators causes a pointer to approach a position at which, when the accumulators are fully charged, it will cause resistance to be added to the generator circuit and finally cut it out entirely, while current used from the accumulators causes the pointer to recede from this position a distance in proportion to the amount of current used.

It will be readily seen, therefore, that the position of the pointer is a direct indication of the condition of the charge in the accumulators, or in other words is a measure of the number of ampère hours stored in the accumulators.

If current be taken from the accumulators when the generator is idle, the meter will indicate the amount of current consumed, and will not cut off the charging current when the generator comes into action again until an amount of current equal to that which has been taken out has been put back again.

In the case of night driving, the demand on this system is much greater, since the current is taken for lighting. Under these conditions it depends altogether upon the speed at which the car is being driven whether the accumulators are being charged by the generator or discharged by the lighting of the lamps.

Combined Electric Starter, Lighting & Ignition. (Cadillac.)

In fig. 9 is shown in diagram the Cadillac system—one of the most successful types of electric starter and one that is combined with the ignition system and also supplies illumination for the lamps.

The dynamo-motor normally runs at engine speed supplying current to a six volt battery through an automatic cut-in and cut-out. When the engine speed drops below 300 r.p.m. the battery is cut out from the dynamo, preventing its discharge. The ignition system is now supplied by the battery, which delivers current to the coil and high-tension distributer, which latter is automatically advanced and retarded.

When the engine speed rises above 300 r.p.m. the

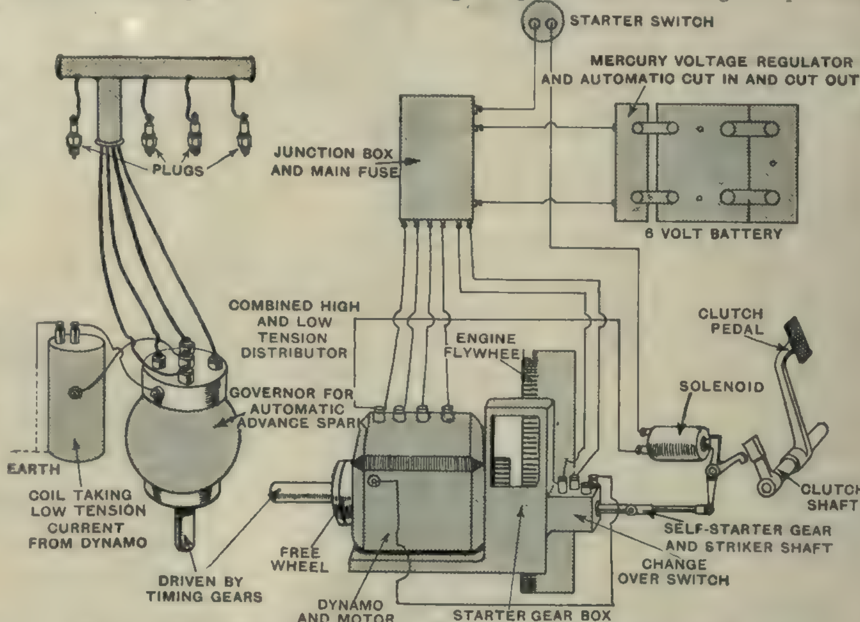


Fig. 9.—The Cadillac combined electric starting, lighting, and ignition system.

automatic cut-in operates, the battery is charged, and the dynamo supplies current to the coil and high-tension distributer.

There is employed a junction box containing a main fuse which acts as a safeguard for the whole system, for self-starting, lighting, and ignition. The solenoid provides a simple means for engaging the self-starter gears. The clutch pedal is depressed and the starting switch closed, which energises the solenoid, drawing the dynamo gear into mesh with the flywheel. The dynamo, which is normally driven through a free-wheel clutch from the engine, rotates the flywheel through a gear reduction of 20 to 1. Normal depression of the clutch pedal only takes the clutch out in consequence of the starting switch being opened.

An "all weather" body built by Salmons of Newport Pagnell, the feature of which is that it may be used either as a totally enclosed car or quite open, or simply with the side windows down and the hood up. In the right hand illustration the side pillars remain up but the windows themselves are down. The left hand illustration shows how neatly the hood folds back and the windows and pillars out of sight.

Auxiliary Suspension.

Advantages of Supplementary Springs. A Review of the Principal Modern Devices.

IT is rather unfortunate that, up to the present time, the name shock absorber has been made to apply in the main to two entirely different and distinct types of mechanism. This naturally leads to some little confusion, which, however, should be needless. First of all, we have the so-called "shock absorber," which consists of a brake arranged between the axle and the sprung part of the car in order to provide additional friction for the expansion of the leaves, and secondly there is the "shock absorber" which takes the form of an elastic spring shackle and leaves the main spring entirely unaffected so long as its own working is concerned. While it is technically true that both devices do absorb shocks, these shocks are of different kinds, for, while the function of the first is to make the road springs more "dead" in action by introducing friction which accelerates the damping out of vertical oscillations of the car, that of the second is to make the springs more lively, or, in other words, to provide a secondary suspension of the car with a view to insulating it from those smaller shocks which the laminated spring is, of itself, unfitted to sustain.

One of the most essential differences between the two is that, whereas the first is particularly adapted for high speed work, the second is more especially intended to promote comfort at moderate speeds, although at least one of this (the elastic shackle) type has been used with advantage on racing cars at Brooklands. This article is not concerned with devices for producing additional friction, it being a review of the principal types of actual supplementary suspension now upon the market.

The Function of the Leaf Spring.

The *raison d'être* of the type of "shock absorber" under review is the shortcomings of the laminated leaf spring, which is a device in which the natural resilience of the spring plates is retarded or loaded by means of the friction between the leaves when in the movement of the whole they individually slide over one another. It is, therefore, essentially capable of insulating the vehicle from heavy shocks. The value of such shocks depends, firstly, on the speed at which the vehicle is travelling, and, secondly, upon the height of the bumps or the depth of the depressions which the wheels encounter. If, as in the case of a racing car, the speed be high, then actually small road inequalities will impart large shocks, and to insulate these from the car short and strong springs will be required in order to provide sufficient rapidity of action. Such springs, however, are unsuitable for moderate speeds, for the reason that they are almost incapable of absorbing the minor shocks due to the smaller surface inequalities of the road.

Progress towards increased comfort has demanded that the effect of such small shocks shall be as far as possible neutralised, and the tendency of the designer has therefore been to install springs sufficiently long and flexible to achieve this end. Chassis dimensions, and the fact that such long and flexible leaf springs are unsuitable for high speeds, impose, however, a limit beyond which it is inexpedient to go with this type of spring, for it will be seen that to achieve comfort under all conditions the laminated spring, if used alone, would need to be here strong and there weak, because if it were flexbile enough to accommodate the small vibrations then it would be insufficiently strong to withstand heavy shocks.

It is for this reason that the elastic spring shackle has been introduced, and also that it has so rapidly sprung into great popularity. By this means, the laminated road spring has its sphere of action limited to the heavier shocks, and for this purpose it is allowed to retain its frictional qualities. For the smaller shocks the main spring becomes, for all practical purposes, an inflexible lever, the movements of which are supported by a resilient spring capable of supplying a rapid reaction.

Spring Periodicity.

The great advantage of the supplementary spring is, therefore, increase of comfort under all conditions, always provided that its vibrations do not harmonise with those of the main spring. This proviso is a matter of considerable importance, for, if the two springs be, as it were, "in tune," their actions, instead of being always in opposition, will periodically come into coalition, and the result will be that the shocks felt by the car would be occasionally increased rather than diminished by supplementary suspension. The same defect is by no means absent in a single spring system, and becomes apparent when the periodicity of road inequalities is either the same or a multiple of the periodicity of the spring vibration.

Regular road inequalities at equal intervals are not met with in this country, at any rate to any marked extent. However, in certain parts of the Continent small *caniveaux* are found to occur with sufficient regularity to provide the necessary harmonic conditions if the car be run at the proper speed. In one of his numerous record runs (we believe it was in a rush from Monte Carlo to London) the late Hon. C. S. Rolls encountered a long stretch of road crossed by regularly spaced depressions which unfortunately coincided at his maximum speed with the periodicity of his car's springs. Had he continued at this critical speed the probability is that the car would have been literally smashed up. As it was the rear passengers had, we are told, some little difficulty in retaining their seats, even though the speed of the car was alternately retarded and accelerated in order to avoid the periodic reaction of the springing. The analogous difficulty, even though it does exist with supplementary suspension, is in most cases easily overcome, as the additional springs are nearly always, as will be seen from the examples described and illustrated hereafter, capable of adjustment as to their loading. Hence their "tune," as it were, can be altered to suit that of the laminated spring, which is, of course, a fixed quantity.

One important point should be noticed, namely, that with elastic shackles the possible vertical movement of the car is considerably increased, and hence in fitting them care should be taken to ascertain that there is sufficient clearance between the body and the back axle and between the tyres and the mudguards to allow for the maximum possible movement.

Amongst the points that are worthy of consideration as applied to supplementary suspension devices are the following: First, it is highly desirable that, in view of the large range of movements which the working parts have to undergo, an adequate system of lubrication should be installed. This is especially necessary when

one considers the liability for wet and grit to get to the moving parts when the car is being washed. In some of the devices no means are taken completely to enclose the mechanism, even when there are several sliding parts. In our opinion this is bad, both on the score of appearance and of wear. Every means compatible with the production of an instrument at a moderate price should be taken to ensure that mud and dirt cannot have access to the working parts of a device which is to be applied in a position in which it frequently gets covered with dirt. Further, such protections must essentially be correctly designed. As was the case with so many of the old chain cases, an ill-fitting covering frequently only means that grit is invited to enter and prevented from getting out, which, of course, is worse than if no protective covering were fitted at all. Next, as previously suggested, some means of adjustment are, if not always absolutely necessary, at the least highly desirable. Finally, every care should be used to avoid side-play.

In regard to the fitting of supplementary springs we confess to some feeling of wonder that they are, as a rule, to be found fitted to the back axle only. So far as tyre wear is concerned this is obvious enough, since the back tyres have so much more work to do than the front ones. The question of the easy steering, however, is of considerable importance, and, apart from the enhanced comfort which is gained thereby, we find that for this reason alone the expense of supplementary suspension for the front axle is warranted by results.

TYPES OF SUPPLEMENTARY SPRING DEVICES.

The Lever Spring Suspension.

This mechanism was, if not actually the first, at least one of the first to be put on the market, and has been in use now for several years. In principle it resembles the general run of auxiliary suspension devices in forming an elastic shackle, though the application of this principle is on quite individual lines, as shown in the accompanying sketch fig. 1. The inner end of each spiral spring is fixed to a cross-shaft (which in the illustration can be distinguished by the square nut on its outer end), and upon this cross-shaft are clamped a pair of levers which extend forward and are anchored to the lower half of the threequarter elliptic spring. The outer end of each spiral spring is shackled to a lever which is supported loosely upon the aforementioned cross-shaft. This lever is, in effect, two levers joined together by a web which appears clearly in the sketch. To the forward end of these levers is connected the upper or quarter elliptic part of the main spring. In other words, the road springs are connected to a species of scissors lever, the tendency of the weight of the car being to wind the spiral spring up, vertical motion of the cross piece ends causing a rotary motion of the cross piece which unites the supplementary springs. The great point of the Lever spring suspension (which it shares with only one other, "the King") is that the loading of the springs, by reason of their arrangement, is progressive, the reason of this being shown in the accompanying illustration, which is purely diagrammatic.

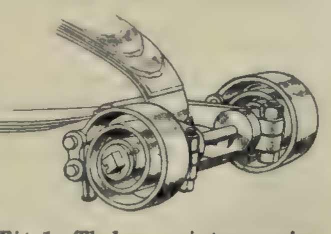


Fig. 1.—The lever spring suspension.

The load is applied to the outer end A of the spiral spring, and the latter being centred at O, the moment of the load about O is the distance A O, which is represented by the line P Q, transferred for purposes of graphic comparison to the perpendicular projection lines in the diagram. When the weight of the car (or what amounts to the same thing in the end, an upward thrust on the axle) has brought the point A to the position marked B, the moment of the load about the centre O is considerably reduced, and is now only equal in magnitude to the line X Y, which is obviously smaller than P Q. Just as in the case of a crankshaft on its power stroke, the moment decreases as soon as the crank has passed its mid-point of the stroke, so in this particular case the resistance which the weight of the car meets with in trying to wind up the spring becomes greater and greater the more it succeeds in doing so. Supposing it to be capable of forcing the point A into the position marked C. Then this latter being vertically beneath O, there is no further tendency to wind up the spring, since the moment has disappeared altogether. By reason of this changing moment the resistance of the springs, which would otherwise be practically constant, is made to increase progressively.

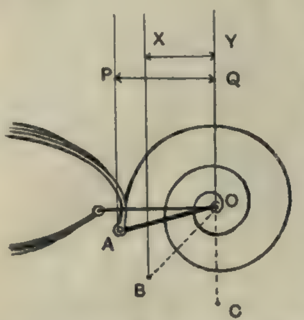


Fig. 2.—Diagram of the lever spring suspension arrangement. The coil spring is drawn out of proportion to show the principle of the device.

As a matter of fact, in actual practice this extreme point C is never reached, as when the scissors levers reach an angle of about 60° they come up against a stop and the supplementary suspension is cut out of action, returning into action, of course, the moment the increased pressure is relieved. The loading of the springs can be adjusted by altering the position of the pair of levers clamped upon the cross spindle, whilst of course for various weights of cars different thicknesses of spring steel are used. The trunnions carrying the cross-bar are provided with ball bearings.

Fig. 1 shows the Lever spring suspension complete as fitted to a threequarter elliptic rear spring, but it is also made in a form for application to springs of all other types, except those compound ones with transverse rear springs, in which case these latter are removed and rigid dumb-irons are fixed to the frame members in their place. It is also made with a single coil spring to suit all purposes, whilst further types are manufactured for fitting to the rear end of the front springs.

The same firm, namely, the Lever Spring Co., Ltd., Janus Works, Queen's Road, Battersea, London, S.W., also make an elastic shackle on more or less standard lines. It must be understood that the type of Lever spring suspension just described is not intended to be fitted to the car by the owner, but requires in most cases special fittings. The Premier "shock absorber," also made by the Lever Spring Co., can, however, be fitted by anyone, and its general arrangement, both in perspective and section, is shown in fig. 3. The weight of the car is supported by two square section helical springs, held at their bases in cups, the stems of which are provided with a special lubricating device. In the solid blocks, through which the vertical stems pass, is a chamber which is filled with grease. Fixed on the vertical stem is a fibre washer which acts as a very slack fitting plunger in this chamber, and by putting

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a slight pressure on the grease either above or below it, according to its direction of motion, forces a small quantity into the working slides, there being sufficient clearance between the edge of the plunger and the chamber to allow the grease to ooze past, otherwise it would all be forced out in one stroke. Grease caps are also provided on the shackle pins. A very neat method of fixing the lower shackle pin is employed. It is screwed into the body of the slide block at one side, whilst at the other side it carries a grooved cheese-head, which is secured in the body of the other slide lock by a split pin which transfixes it from side to side. The lower spring cups, it is interesting to note, are die-castings of a special aluminium alloy.

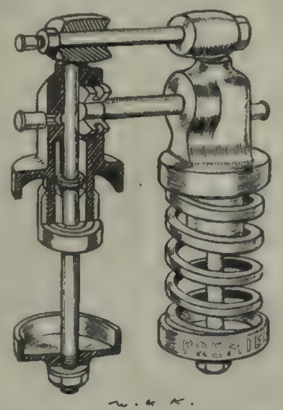


Fig. 3.—The Premier shock absorber partly in section with one spring removed.

The Hobson.

This is amongst the simplest of its kind, as will be seen by the accompanying sketch, fig. 4, beyond which scarcely any description is necessary, except to point out that small relief springs are fitted between the shackle pins in order to prevent noise in case of a rapid release of pressure on the lower helical springs. The latter are of square section steel, and are made in a variety of strengths to suit the weights of different chassis. The lubrication system employed is very simple; as shown in the part sectional sketch fig. 5, both the shackle pins are hollow and cross drilled. Grease or oil is intended to be occasionally injected into this passage by means of a pump specially made for the purpose; the nose of the grease pump is inserted into one of the holes occupied in the drawing by screw plugs, the function of which is to ensure that, once there, the grease cannot receive an admixture of grit. The lower shackle pin is lubricated through a hole (not shown in the sketch) at the back of the slide block. This device is supplied by H. M. Hobson, Ltd., 16, Pall Mall, London, S.W.

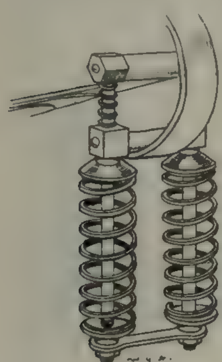


Fig. 4.—The Hobson shock absorber.

Daimler and Standard.

The auxiliary suspension shown in fig. 6 is a characteristic of some Daimler models. It will be noticed that the double helical springs themselves have to resist any tendency towards side-play The neatness of the fitting suggests that to be at their best in the matter of appearance supplementary suspensions should be made an integral part of the chassis and not a mere addition. The arrangement of the device is so simple and well known that no detailed description is necessary. A very similar and even neater arrangement is fitted to the Standard cars.

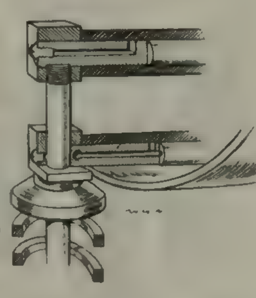


Fig. 5.—The lubrication arrangement on the Hobson shock absorber.

The J.M. Shock Absorber.

This make was amongst the first of the detachable type to be introduced, and is made in several types as shown in the accompanying sketches, figs. 7, 8, and 9. The principle is in every case the same. The secondary suspension consists of a square section helical spring contained within a cylindrical covering in which the spring cup forms a sliding dustproof plunger. In one type, as shown in fig. 7, the stem is of U form, and is bent round the shackle pin at its upper end. For application to threequarter elliptic springs, and to half elliptic springs which are fitted as to their rear ends either immediately above or immediately below the rigid dumb-iron, the J.M. device is made in twin form as shown in fig. 7, whilst fig. 8 shows it as a single type designed for use with half-elliptic springs in which the spring is carried at the side of the fixed dumb-iron. Fig. 9 shows a model designed for fitting to the rear end of the front spring. In this case the stem is a single rod. A special model is made to take the place of the front shackle of the latest type of De Dion Bouton cars. Jacquet-Maurel and Condac, 92, Gloucester Road, London, S.W., are the agents.

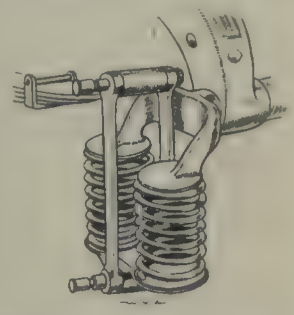


Fig. 6.—Supplementary springs as fitted to some Daimler models.

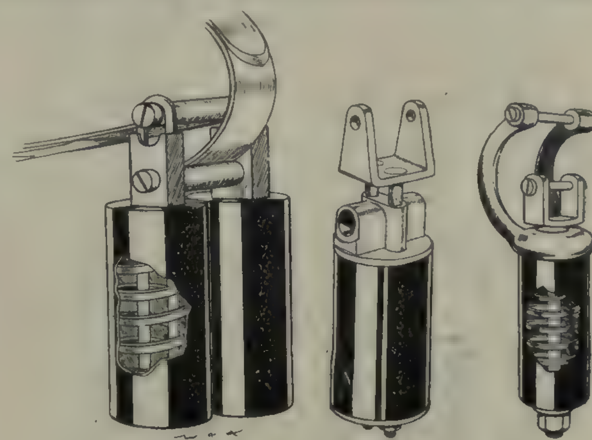


Fig. 7. Fig. 8. Fig. 9.
The J.M. shock absorbers.

K.A.P.

The principal feature of the K.A.P. device is the employment of twelve separate springs, six in each half, and both halves of the mechanism being identically the same in construction. Each buffer is in triplicate, and consists of three round section springs, one inside the other and of alternate pitch. The shackle pin of the upper part of a threequarter elliptic spring, or the dumb iron, as the case may be, is supported by two strong blocks which carry the upper spring cups and slide up and down two pairs of vertical bolts. By utilising this compound construction wear is, of course, reduced to a minimum.

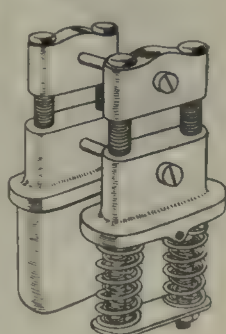


Fig. 10.—The K.A.P. shock absorber.

as the frictional surfaces are exceedingly large. In the sketch, fig. 10, half of the device is, for the sake of illustration, shown minus its aluminium waterproof case, which screws on to and makes a permanent fixture with the slide blocks and entirely encloses the buffer springs. Small relief springs are provided on the slide rods between the upper and lower blocks, but the principal function of these is to hold the grease, which naturally oozes out of the lower case and thus maintains the slide rods constantly lubricated therewith. A variety of different strengths of springs are supplied for use on chassis of different weights. This device is sold by Messrs. Fenestre, Cadisch, and Co., Harp Lane, London, E.C.

Telesco.

This device differs from all others of the same type in having an artificial braking load applied to the expansion of the supplementary coil springs. The external appearance of the Telesco is shown in fig. 11, fig. 12 being a sectional diagram. From the latter it will be seen that square section helical springs are used. Each spring is, however, surrounded by a cylinder some threequarters full of glycerine. The bottom end of the spring is carried on a plunger which is a sliding fit in the bore of the cylinder, and this plunger is fitted with a simple type of non-return valve which allows compression of the spring to be carried out practically unrestricted. The valve consists of a flat disc held by a light spring over holes drilled in

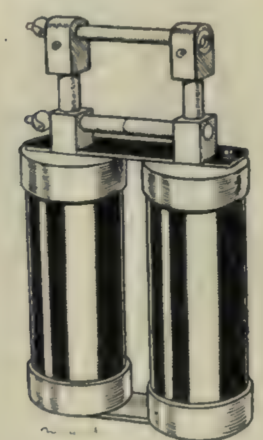


Fig. 11.—The Telesco shock absorber.

Fig. 12. Diagrammatic section of the Telesco device.

a base of the plunger. The object of this braking effect is to prevent the tendency which an unloaded and unfrictional spring might otherwise have of bouncing and surging. It will be seen that in this case an entirely new principle is employed, inasmuch as, although the frictional brake is introduced, the main laminated spring is allowed to work under its ordinary conditions, hence, after the supplementary spring has been compressed through the wheel striking an obstacle, the leaf spring can exercise its rapidity of action without impediment, but, whilst it is regaining its normal position, the loaded plunger from the supplementary spring is also descending its cylinder against the resistance of the glycerine, and this action continues after the road spring has regained its normal shape. By this means the suspended part of the car is given a much longer time to come to rest, and, other things being equal, this means that the sharp peak of the oscillating diagram is considerably lowered. It is also probable that the fact that the spring shackle is frictionally loaded in one direction has an exceedingly good effect in resisting the tendency of the car to roll when proceeding round a corner. The Telesco device is made by Polyrhoë Carburetters, Ltd., 144, Portland Street, London, W.

Junior.

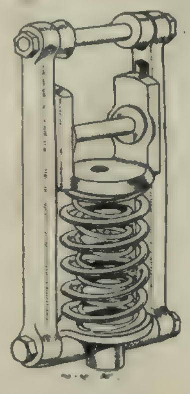


Fig. 13.—The Junior shock absorber.

The Junior device is, as will be seen from the illustration, fig. 13, one of a very simple kind, a very good point being the manner in which the slide rods for the vertically moving cross piece are machined in the side of the main hangers so that there is very little difficulty in keeping them full of grease. There are two springs, both round in section and one inside the other, wound in opposite helices. A bolt can be inserted through the lower spring cup and screwed into the upper one, so that the spring can easily be held in compression, and thus no difficulty presents itself in the process of fitting the device to a car. Packing pieces of different widths are put upon the shackle pins in order to make a good fitting to any standard springs. The device is sold by Harmens Motor Agency, Ltd., Great Pulteney Street, Beak Street, London, W.

U.M.I. Suspension Compensator.

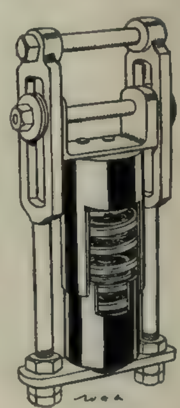


Fig. 14. The U.M.I. suspension compensator.

Fig. 14 illustrates the U.M.I. "Suspension Compensator," as it is called. In this case the buffer is contained within a single telescopic cylindrical casing, and consists of three separate concentric square section helical springs, one inside the other. In order to prevent any tendency of the springs to bind when in action they are made of opposite helices. The covering box is half filled with grease so as to lubricate most of the working parts without further attention. The device is sold by the United Motor Industries, Poland Street, Oxford Street, London, W.

The King Shock Absorber.

It has been mentioned previously that the King is a shock absorber of the progressive type in which this very advantageous feature has been introduced in an extremely practical and simple manner. Reference to fig. 15, which is a perspective view of the King device, shows that it is provided with quadruple buffers, each of which is of the compound type as shown in the diagrammatical section fig. 16. The arrangement of the four vertical bolts, reaction springs, and the fitting of the shackle pins is obvious from the perspective drawing, whilst

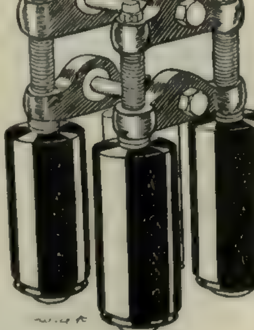


Fig. 15.—The King shock absorber.

the diagram indicates the internal design of each buffer. There are three round section helical springs, one inside the other. Each abuts against the top of the outer cylindrical casing. Between the lower ends of the sliding base of this outer casing are inserted six concave spring washers, each pair of which is of heavier section, and consequently greater strength, than the one immediately below it. These concave washers, a perspective sketch of one of which is given immediately below the diagram, are split radially so as to allow for expansion, whilst between each pair is inserted a fibre washer to prevent the possibility of a heavy shock crushing them beyond their range of elasticity. It will at once be seen that this clever arrangement provides a compound spring which is thoroughly progressive. It may be noticed that the telescopic casing is made as perfect a fit as possible and also extremely strong so as to provide a large amount of bearing surface, and by stiffening the tension rods it reduces the possibility of side-play developing. These shock absorbers are made in several sizes, the smallest of which is said to be capable of taking a shock up to 4,000 lbs., whilst the largest will take one of double that amount, that is to say, before the elasticity of the buffer reaches its limit and the shackle becomes temporarily a rigid one. It will be seen that the strength of the springs can be adjusted to suit the weight to be carried by the nuts at the top of each tension rod. The makers of this device are the Progressive Spring Co., 6, Alwyne Square, Canonbury, London, N.

Fig. 16. Diagram of the King shock absorber.

Hermes.

The design of this device is shown both in perspective and part section in fig. 17. Twin round section springs are used, and are encased in telescopic cylindrical boxes, the upper parts of which are united by a cross-piece which abuts against the nuts at each end of the spring pin, this latter working in slides cut in the flat parts of the spiral spring stems. Models are made for adapting to various arrangements of road springs. The makers are Mestre and Blatge, Store Street, Tottenham Court Road, London, W.C.

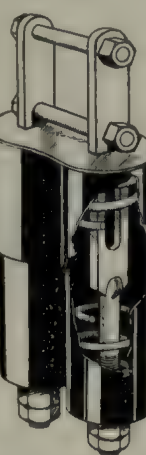


Fig. 17. The Hermes shock absorber.

Glissade and Nevajah Shock Absorbers.

Figs. 18 and 19 show one form, out of many, of the Glissade shock absorbers which have been introduced by Messrs. Thomson Bennett, Ltd., Cheapside, Birmingham. The sketches show the type designed for threequarter elliptic springs. The square section steel spring is carried between two cups, the upper being formed also to act as guides for the two bolts which pass from the lower cup to the cross-pin of the portion attached to the semi-elliptic spring end. Where these bolts pass through their guides grease cups are provided, and these also supply lubricant to the hollow studs taking the place of the lower shackle pin. A similar construction obtains as regards the upper studs.

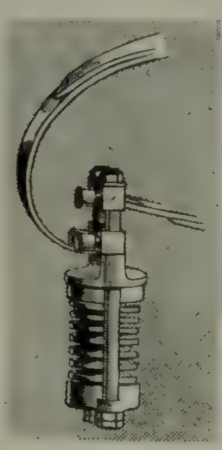


Fig. 18.—The Glissade shock absorber fitted to a threequarter elliptical spring

It will be seen from fig. 19 that the fitting, assembling, and adjustment is quite a simple matter by reason of the manner in which the hollow studs are secured to the side bolts, and the provision of adjusting nuts at the bottom ends of the side bolts beneath the lower cup. At the top a flat cross-plate keeps the bolts from splaying when the weight is applied.

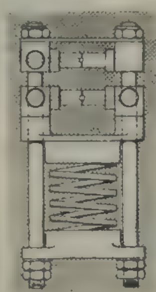


Fig. 19. The hollow spring pins of the Glissade shock absorber

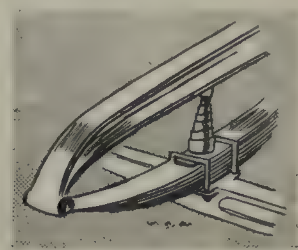


Fig. 20.—The Nevajah spring buffer in position on a front spring.

Messrs. Thomson Bennett, Ltd., have for some years past sold a device called the Nevajah. This is another style of shock absorber, which is intended to prevent or damp excessive spring motion by providing, in the form of a spiral spring, a buffer between the semi-elliptic spring on the axle and the chassis frame. By means of this device the car is prevented from "bumping," that is, the axle is prevented from hitting the frame, when the car is travelling at high speeds on rough roads, while in addition it is claimed that it prevents the car from swaying at corners by aiding or backing the existing semi-elliptical or other type of spring on that side of the car towards which the weight is thrown by centrifugal force.

The Dunhill Shock Absorber.

Fig. 21 illustrates a shock absorber marketed by Messrs. Alfred Dunhill, Ltd., 359, Euston Road, London, N.W. It is of the supplementary spring type, having several very excellent qualities to recommend it. Its construction, which is of the simplest possible kind, is made clear in the illustration herewith. A special feature, and a very valuable one, is the use of a soft leather cover, which allows the moving parts to reciprocate quite freely, and at the same time prevents to a great extent the admission of dust, mud, and wet. The cover is readily detachable, and removal takes but a few moments, so that when dirt does get in it can readily be removed and grease put in its place. This overcomes the difficulty from which very few shock-absorbers of this type are free, and it will easily be conceded that the black leather casing does much to combat the scrappy look which naked springs, especially when dirty, as they usually are, are apt to have.

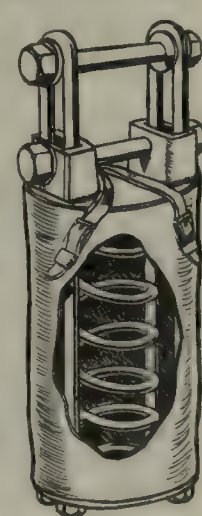


Fig. 21.—A Dunhill shock absorber.

Auxiliary Suspension.

The Brew-Ree Shock Absorber.

A neat shock absorber which Messrs. Brown Bros., of Great Eastern Street, London, E.C., are now selling is of the supplementary spring type, and goes under the name of the Brew-Ree. This is shown in fig. 22, from which it will be seen that the device is completely enclosed. The internal springs are two helical ones, one inside the other, giving a progressive and easy action. The case is quite oil-tight, and complete lubrication for a long time is assured by filling it about one-third full with lubricant.

Fig. 22. The Brew - Ree shock absorber.

The Parsons Shock Absorber.

The latest addition to the Parsons (of non-skid fame) programme is the Parsons shock absorber, than which no more neatly arranged device has been put upon the market. It is practically explained by the sketch fig. 23, which shows one cell complete and the other with the case removed. This case, which is of steel, forms the cylinder of an inverted air pump, the leather of which, it will be seen, is immediately underneath the platform of the rod upon which the spring is carried. The latter is of the volute type—a species of spring which is practically unbreakable, and which maintains its tension almost indefinitely. The case is easily kept lubricated, as it provides a perfectly weather and dust proof cover. The action of the device is very easy to follow. On the down stroke of the supplementary spring the pump offers no appreciable resistance at all to vertical motion, but on the up stroke the air above the piston is trapped in the top of the case, whence it can only escape comparatively slowly. On the up stroke there is, therefore, a dash-pot action, which effectively damps any tendency in the spring to develop a bounce. We need hardly say that the complete automaticity and the small number of the working parts of this clever device are most admirable features, and it should have a large future. It is marketed by Messrs. the Parsons Non-skid Co., 23, Store Street, London, W.C.

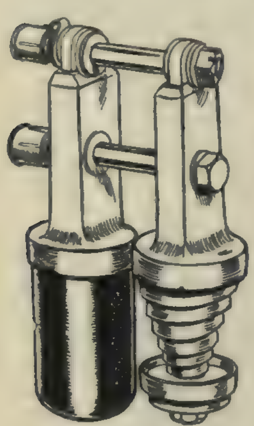


Fig. 23.—The Parsons shock absorber.

The H. and S. (Houdaille) Shock Absorber.

This shock absorber, which has much to recommend it from the point of view of simplicity, and also of accurate adjustment to the load to be sustained, is sold by Messrs. A. A. Godin, 1, Red Lion Square, Holborn, London, W.C. It consists of a steel stirrup or sling A attached by bolt pins to the upper and lower ends of the springs in place of the usual shackle plates. The lower bolt pin is carried in a sheave B free to slide vertically in the upper part of the stirrup A. The under side of the sheave has a rod or guide C which passes down through the springs and the hollow screw D set in the foot of the stirrup. Round this rod or guide are helically and conversely coiled the outer and inner springs E and F, the outer spring bearing on the bottom of the stirrup as to its lower end, and against the under face of the sliding sheave B as to its upper end. The upper end of the inner spring F bears also against the lower face of the sheave B, and its lower end is carried on a collar forming the upper part of the hollow screw D screwed into the foot of the stirrup. The adjustment of the shock absorber is obtained as follows: The outer spring is made of sufficient strength to carry the car without passengers, and the adjustment to the load is obtained by increasing or decreasing the compression of the inner springs.

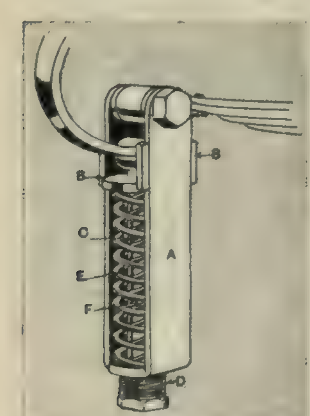


Fig. 24.—The H. & S. shock absorber fitted to a threequarter elliptic spring.

The S.S. Shock Absorber.

A very prominent point connected with the S.S. shock absorber is the fact that it is made in two forms, both for compression and tension, and is therefore claimed to be capable of suiting the conditions of any and every make of car. Fig. 25 shows the complete device assembled and mounted on a threequarter elliptic rear springs and also one-half of the device (which consists of two halves of exactly the same construction) in section.

Each half consists of only three distinct pieces, of which two are identical, thus making for ease and cheapness of manufacture as well as accuracy in machining. The two shanks of the spring bodies slip over one another, as shown in the small section, so that when in working position their ends are dead in line and are prevented from shifting from side to side by the shackle pins to which they are secured. At the same time they provide wide bearing surfaces, which to a large extent remove the liability of side play developing. Springs of varying strengths to suit cars of different weights can, of course, be used. The S.S. shock absorber is made by Messrs. Boon and Porter, Ltd., Castelnau, Barnes, London, S.W.

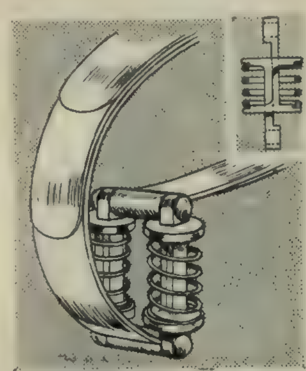
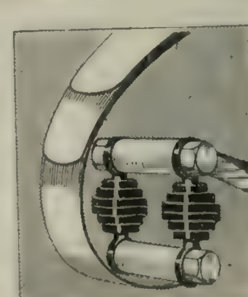


Fig. 25.—The S.S. shock absorber on a threequarter elliptic spring.

The F.G. Spring Shackle

Fig. 26.—The F.G. spring shackle illustrated herewith is one of the simplest and cheapest devices of its kind on the market. A glance at the accompanying paragraph and illustration will show that it is somewhat similar to the S.S. shock absorber. The F.G. spring shackle is sold by Mr. H. W. Bradbury, 41, King William St., London, E.C.



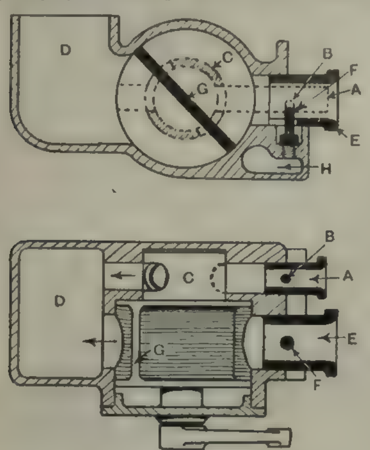
"Loose" Carburetters.

Outlines of the Principles of the Most Widely-used Types.

A concise illustrated description of the operation of Carburetters at present on the market, which may be purchased "loose," *i.e.*, independently of the chassis to which they are to be fitted. In most cases the instruments described are produced by firms which specialise on carburetter design and manufacture. The descriptions and illustrations of the float chambers have in the majority of cases been omitted as confusing the issue, and having no direct bearing on the design.

No. 1.—The Bailey Carburetter.

AIR enters a small choke tube A past the small jet B, the mixture passing through the throttle valve C into the mixing chamber D. After the throttle valve C has been rotated through a part of its travel the larger choke tube E comes into operation, the current of air passing over the larger jet F through the large diameter of the throttle valve into the mixing chamber D. In the illustration the small gas passage through the throttle barrel C is shown fully open and the gas passage past the baffle plate G just about to open. For purposes of adjustment the choke tubes A and E are easily withdrawn and interchanged with others of different sizes, the same remark applying to the jets B and F, which are exposed by the removal of the choke tubes. Marketed by W. H. Bailey and Co., Albion Works, Salford, Manchester.



Sectional elevation and plan of the Bailey bi-jet carburetter.

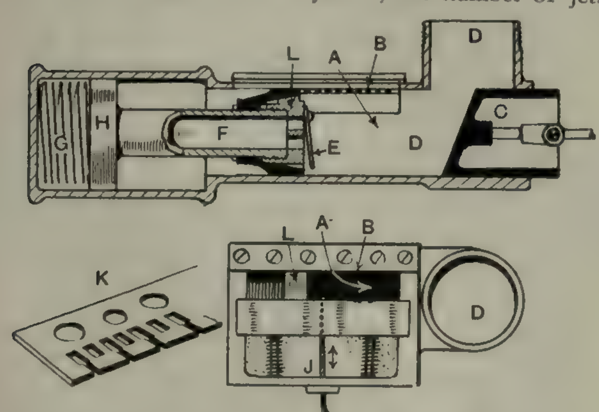
A. Small choke tube.
B. Small jet.
C. Small throttle valve.
D. Mixture chamber in connection with induction pipe.
E. Large choke tube.
F. Large jet.
G. Baffle plate across large throttle valve.
H. Portion of hot water-jacket.

No. 2—The Polyrhoe Carburetter.

In this carburetter air is drawn in the direction of the arrow A past a row of jets B, the number of jets exposed being governed by the position of the throttle. The actual working of the carburetter is briefly this: When the throttle C is in the position shown, a certain suction is set up in the inlet pipe D. This suction opens the flap valve E, when a vacuum is formed in the piston rod F and the chamber G. This vacuum in the chamber G draws the piston H to the left, thereby uncovering a certain number of the jets at B. If the throttle be opened further the suction is increased and the piston is drawn still more to the left, uncovering still more petrol orifices.

The mixture is regulated by the slide L, the air orifice A opening as block L slides to the left. The slide J seen in the plan view is arranged to slide to and fro in the directions of the double-headed arrow by means of a Bowden wire connected to the dashboard.

By means of this device the air supply may be varied for any position of the piston and the sliding block L, which in turn is governed by the suction in the induction pipe. When the throttle opening is reduced the lowered suction in D enables the spring in the suction chamber G to replace the mixture slide L, so that when the throttle is entirely closed the mixture slide L is on the extreme right, covering all the jets and also closing the airway A. The shape of the jet plate B is shown at K in perspective. Marketed by Polyrhoë Carburetters, Ltd., 144, Great Portland Street, London, W.

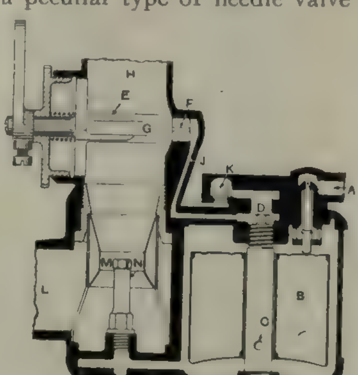


The Polyrhoe carburetter. A sectional elevation and a plan of the Polyrhoe carburetter, also a sketch of the comb-like jet plate.

A. Air intake.
B. Row of jets.
C. Throttle piston.
D. Induction pipe.
E. Flap valve.
F. Hollow piston rod.
G. Suction chamber.
H. Piston.
J. Air regulator.
K. Jet comb.
L. Combined petrol and air slide.

No. 3.—The Solex Carburetter.

Petrol enters this carburetter at A and flows through a peculiar type of needle valve into the float chamber



A vertical section of the Solex carburetter.

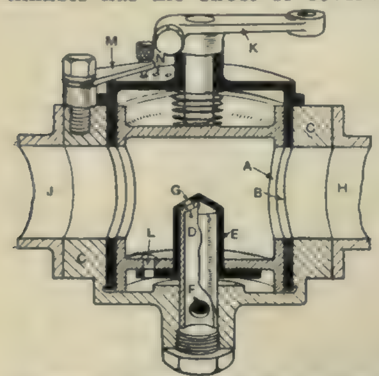
A. Petrol inlet.
B. Float chamber.
C. Petrol passage.
D. Small jet.
E. Butterfly throttle.
F. Passage in throttle spindle.
G. Slot in throttle affording communication between passage J and induction pipe H through passage F.
H. Induction pipe.
J. Rich mixture passage.
K. Ball air valve.
L. Main air intake.
M. Choke tube.
N. Main jet.

B, whence it flows through the orifice C into the standard of the jet D. When starting up, the throttle E is closed with the exception of a small passage F communicating between a slot G in the throttle spindle, which in turn communicates with the induction pipe H, and the passage J. On starting up, the suction draws petrol through the small jet D, passages J and F, into the slot G, and so into the induction pipe H, the ball valve K being lifted sufficiently to give a mixture suitable for starting purposes. As the throttle E is opened, however, the increased amount of air necessary is drawn in through the air intake L through

the choke tube M and past jet N, the gases travelling past the throttle E into the induction pipe H. Marketed by S. Wolf and Co., 138, Southwark Street, London, S.E.

No. 4.—The White and Poppe Carburetter.

This carburetter consists of two shells A and B, carried concentrically in a casing C. The jet D which protrudes through the bottom of the inner shell is covered by a thimble E, this thimble being carried by the inner shell A. The orifice in the top of the jet itself is drilled eccentrically with the centre line of the jet and registers with a jet orifice G in the thimble; it is, therefore, obvious that a slight rotation of the thimble has the effect of covering or uncovering the jet orifice D. Bearing this in mind, an understanding of the action of the carburetter should present no difficulty. On full throttle the shells A and B are so placed that there is a clear passage through from the air inlet H to the induction pipe J as shown in the illustration. Petrol enters at F and flows through the jet orifice D and the corresponding orifice G in the thimble E, meeting air from the intake H and flowing into the induction pipe J. On throttling down by means of the lever K the inner shell A is rotated, and with it the thimble E by means of the pin L, thereby cutting down the petrol supply in proportion to the cutting down of the air supply, the diminution of the petrol supply being carried out as previously described, *i.e.*, by means of the eccentric jet orifices. A fine adjustment of the air supply for slow running is locked by the spring M, which registers in any one of the three holes N in the roof of the outer shell B. The position of this outer shell is varied by rotating it slightly in its casing, and its ultimate setting is locked by the pin on the extremity of M registering in one of the three holes N.



A vertical section of the White and Poppe carburetter.

A. Throttle shell carrying jet thimble E.
B. Slow running adjustment shell.
C. Casing.
D. Jet orifice.
E. Jet thimble.
F. Petrol supply.
G. Jet orifice in thimble E registering the jet orifice D.
H. Air inlet.
J. Induction pipe.
K. Throttle lever.
L. Pin by means of which shell A rotates thimble G.
M. Registering pin for shell B
N. Registering holes.

The more recent models of the W. and P. carburetter embody two interesting devices. The first is the elimination of the slight whistling noise which occurred at certain throttle positions by the introduction on the throttle valve of two small corrugated plates, which deflect the stream of air and prevent the production of any sound. The other improvement is the introduction of an acceleration lever, whereby the admission of air to the mixture can be adjusted with very great nicety to give the best possible results. This extra air so admitted is taken through the spindle of the throttle sleeve, the cam valve controlling the air being attached to the throttle lever and revolving with it. In addition to these adjustments the original one of altering the relation of the air port to the inlet port by a lever on the cover of the throttle chamber is still adhered to. Marketed by White and Poppe, Ltd., Coventry.

No. 5.—The S.U. Carburetter.

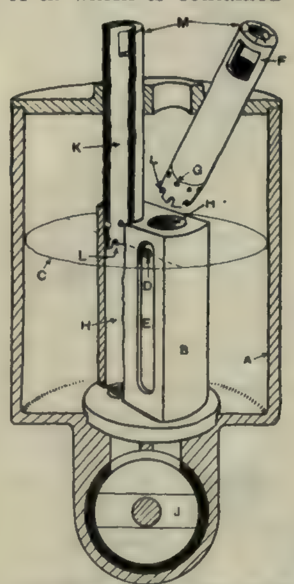
In this device the flow of petrol past the jet is directly controlled by means of a needle. The suction in the induction pipe A operates through passage B upon the bellows C, which carries a needle D. As the throttle is opened the vacuum in the bellows C lifts the piston G and the needle D, and so allows an increased and correctly proportioned amount of petrol and air to flow into the induction pipe A. At starting and during slow running the piston G almost closes the air intake passage, giving a small choke tube effect upon the decreased jet area. Marketed by the S.U. Co., 386, Euston Road, London, N.W.

The S.U. carburetter.

A. Induction pipe.
B. Connecting passage between induction pipe and bellows C.
C. Bellows.
D. Needle controlling petrol orifice.
E. Air intake.
F. Guide for piston G.
G. Air control piston.
H. Throttle.
J. Petrol inlet.
K. Water jacket.

No. 6.—The Welsh Carburetter.

This carburetter takes the form of a float chamber A in which is contained a standard B surrounded by a float, which is not shown in the illustration for the sake of clearness. The petrol level is normal at C, *i.e.*, level with the hole D. This hole is in a milled slot E, the slot being covered with gauze—an arrangement which prevents the washing of the petrol affecting the supply to the hole D. On starting up, the air is drawn down the tube F and meets the petrol which passes from D through the gauged jet G which registers with the hole D. The air and petrol then pass together down the column H in the standard B, and so into the revolving throttle J, where they are mixed with a supply of hot air before passing into the induction pipe. An exactly similar action takes place in the column K, two columns being provided to give a more sensitive action to the carburetter at low speeds. The adjustment of the carburetter is effected by the positioning of the tubes F and K, these being provided with registering notches L corresponding to the various sized jets G. As these tubes protrude through the top of the carburetter and are provided at their extremities with graduations M, there is no necessity



A diagrammatic section of the Welsh carburetter, the annular float being omitted for the sake of clearness.

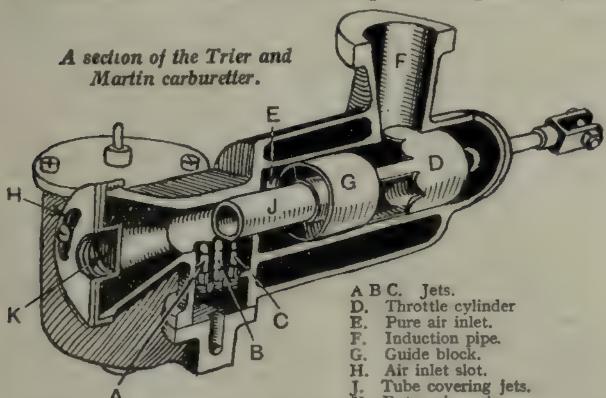
A. Float chamber.
B. Central standard.
C. Petrol level.
D. Petrol passage to jet.
E. Gauze covered slot which acts as a damper to the petrol entering D.
F. Air inlet tube.
G. Gauged jets.
H. Gas passage through B.
J. Revolving throttle.
K. Air inlet tube.
L. Positioning notches.
M. Adjusting index.

to dismantle the carburetter in order to make adjustments.

After the throttle has arrived at the fully opened position, a further movement supplies pure air to the engine. Marketed by Thomson Bennett, Ltd., Cheapside, Birmingham.

No. 7.—The Trier and Martin Carburetter.

This carburetter, unlike most of the foregoing, has three jets, A, B, and C, which are all covered when the throttle piston D is on the extreme left, this position allowing pure air only from the port E to pass into the engine through the induction pipe F. In the diagram the port E is shown visible; in reality it is further to the right behind the guide block G. When the throttle D is drawn to the right, the block G first covers the air port E, thereby completely closing the passage to the engine. Further movement to the right uncovers the first jet A, air entering at H and through a fine atomising air spray over each jet as uncovered. The air and petrol together pass



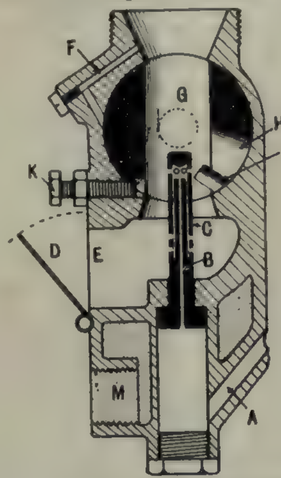
A section of the Trier and Martin carburetter.

A B C. Jets.
D. Throttle cylinder
E. Pure air inlet.
F. Induction pipe.
G. Guide block.
H. Air inlet slot.
J. Tube covering jets.
K. Extra air spring.

through the stem J to the induction pipe F. Further movement of the throttle slide D to the right uncovers the jets B and C in sequence. On full throttle opening with all three jets uncovered, extra air is allowed to enter through the port E and a clever device K, consisting of a spring closed at one end. The suction behind this closing plate at high speeds is sufficient to open the spring slightly and so allow air to pass between the coils of the spring. Marketed by Trier and Martin, Ltd., New Church Road, Camberwell, London, S.E.

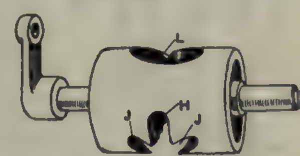
No. 8.—The Claudel-Hobson Carburetter.

A special feature of this carburetter is the peculiar formation of the throttle valve. The petrol enters at A and passes up the jet B, which, it will be seen, is of peculiar construction. Surrounding the jet proper is a sheath C, which is pierced by holes top and bottom, this arrangement producing an atomising effect upon the petrol issuing from the jet proper B. For starting up, the flap D is closed over the air inlet E, a very rich mixture passing through the passage F when the throttle G is closed. After the engine has been started the flap D is opened, and the mixture passes through the throttle block G, and on opening the throttle further the passage F is cut out by the throttle block as shown. By this time a small slot H surrounding the jet comes into operation, and as the throttle is opened and the volume of gas passing the throttle block increases the slot H is opened out to form two wide cross slots, the form of which is shown at J. Further movement of the throttle brings the full throttle opening into operation as shown in the section. A fine adjustment of the low speed mixture is given by the adjusting screw K. The size of the jet orifice is determined as usual, the shape of the apertures H and J being settled by the makers, and remain constant for each carburetter. A small niche L is cut in the throttle which allows sufficient mixture to pass when the engine is working dead slow



Two views of the Claudel-Hobson carburetter.

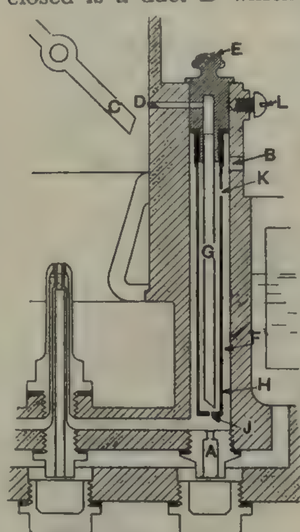
A. Petrol inlet.
B. Jet.
C. Sheath surrounding jet.
D. Flap valve over air inlet.
E. Air inlet.
F. Petrol vapour by-pass.
G. Throttle block.
H J. Low speed mixture slots in throttle block.
K. Lowest speed mixture adjusting screw.
L. Niche in throttle supplying sufficient mixture for dead slow free running.
M. Water-jacket.



or running light. Marketed by H. M. Hobson, Ltd., 16, Pall Mall, London, S.W.

No. 9.—The Zenith Carburetter.

This carburetter has a double jet, the inner one being connected direct to the float chamber; the outer one is in connection with a tube into which petrol is allowed to flow through the orifice A. Subjected to the suction of the engine when the throttle C is nearly closed is a duct D which leads into and through the plug E, the latter being a push fit in the well F. The duct D communicates with a tube G bevelled at the bottom and lying within the intermediate tube H,



Part sectional view of the latest pattern Zenith carburetter showing slow-running attachment.

A. Plug with gauged petrol orifice.
B. Air inlet.
C. Butterfly throttle
D. Petrol duct.
E. Plug carrying inner and intermediate tubes.
F. Petrol well.
G. Inner tube conveying mixture to duct D.
H. Intermediate tube with gauged petrol orifice J and air orifice K.
J. Gauged petrol orifice in intermediate tube H.
K. Gauzed air orifice in intermediate tube.
L. Set screw securing plug E.

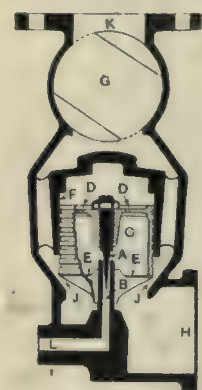
which in its lower capped end has a gauged orifice J. When the engine is not running, or when it is running very slowly, the well F contains petrol to the height, approximately, of the petrol level in the float chamber. This supply of petrol finds its way from the float chamber through the gauged orifice in the plug A. When the engine is started it draws immediately upon the petrol in the intermediate tube H, and so obtains practically pure petrol, but after a few revolutions of the engine that source of supply is used up to be replenished at a definite rate by the liquid passing through the orifice J, air passing in at B and K to give the correct mixture. So long as the throttle is not opened and the engine is not run fast the slow running device supplies all the necessary mixture, but when the throttle is opened this source of supply cannot cope with the demand, and the main jets comes into use. The slow running device is a feature of the Zenith carburetter, and the means of adjusting this device are also interesting as variations of the air and petrol

Loose Carburetters.

supplies can be made by determining the sizes of the holes J and K in the tube H. Marketed by the Zenith Carburetter Co., 17, Harp Lane, London, E.C

No. 10.—The Scott-Robinson Carburetter.

In this carburetter a needle A which projects into the jet B is carried by a piston C, which in turn is free to slide up and down in the guide F. On the throttle G being opened, the air enters at H and passes up through J to the induction pipe K. In passing J it lifts the piston C, thereby raising the needle A out of the jet B and allowing the petrol to flow. The petrol flowing through the jet falls to the bottom of the piston C, and is drawn out through the small holes E round the bottom of the piston, and mixes with the air passing through J. The more the throttle is opened the more the suction past J raises the piston C and with it the needle A, thereby allowing extra petrol to flow through the jet B and thence through the holes E into the air flow past J, and so to the induction pipe. Marketed by Mr. M. Scott Robinson, 24, Norfolk House Road, Streatham, London, S.W.

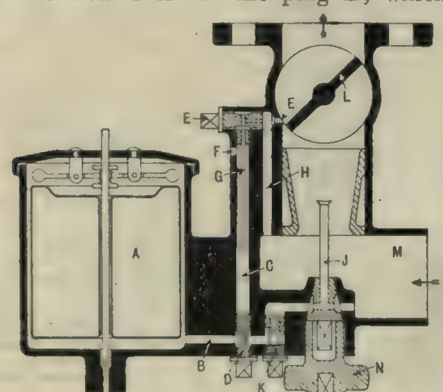


A vertical section of the Scott - Robinson carburetter.

A. Jet needle.
B. Jet.
C. Piston.
D. Air release holes.
E. Petrol orifices.
F. Guide for piston.
G. Throttle.
H. Air inlet.
J. Air passage past piston C.
K. Induction pipe.
L. Petrol inlet.

No. 11.—The Sthenos Carburetter.

The float chamber A is of the usual type. From it petrol flows by the channel B into the well C. Its entry to the well C is *via* the plug D, which has a very small orifice, so small, in fact, that more petrol cannot enter the well C than can be taken by the engine pilot jet E, which also takes the form of a screw plug. In the well C is an air hole F, so that it will be seen that the well is open to the atmosphere. Down this well a small tube G, connected to the pilot jet E, runs, and the air for the pilot jet is taken up the aperture H, and (when the throttle is as shown in the diagram) has no effect upon the main jet J, which is fed by petrol through the same channel B as the small jet, but the petrol passes through a helical passage in the plug K, which the maker terms a resistance, and the mission of this will be explained later. With the throttle L in the position shown, the main jet J is closed to the engine, but the pilot jet E is open to it. Now the throttle can be adjusted by a stop so that the engine will just run on the jet E and the air which comes up H, and which, it will be observed, places no suction on the main jet J, as the volume of air is so small and the main air intake M so large by comparison with the air channel H, which supplies all the air required for the small jet As soon as the throttle is opened the suction on the main jet J commences, and the petrol drawn through it causes the level of the petrol in the pilot well to fall. The further the throttle is opened, the more completely is the pilot jet E put out of business, as not only is practically all suction removed from it, but it has no petrol to serve, as the level in the well C falls below the bottom of the pilot jet tube G. To prevent an undue flow of petrol out of the main jet at high engine speeds when the suction is at its strongest, it will be seen that the helical plug K is inserted in the petrol channel B. While this has no effect at low fluid speeds, it acts as a brake or resistance at high fluid speeds, and, consequently, an undue proportion of petrol to air is not supplied to the main jet at high speeds; indeed, at the highest speeds the level of petrol descends to practically that of the top of the plug D.



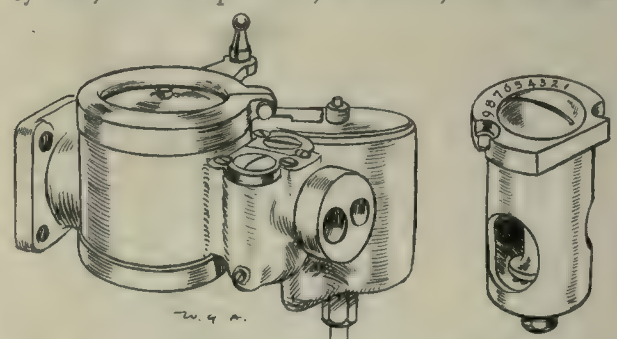
The Sthenos carburetter.

A. Float and float chamber.
B. Petrol channel to both jets.
C. Petrol well for pilot jet.
D Entry plug to pilot well C.
E. Pilot jet orifice.
F. Air hole to pilot well.
G. Petrol tube to pilot jet.
H. Air channel for pilot jet.
J. Main jet.
K. Helical resistance to check flow to main jet at high fluid speeds.
L. Throttle.
M. Main air orifice.
N. Lock nut to main jet, also serving as box key to all parts of carburetter.

One of the good points of this carburetter scarcely realised from the drawing is that the nut N beneath the jet not only serves as a lock-nut to hold the jet in position, but, when it is unscrewed, the square hole in it serves as a box key or spanner by which the jet can be instantly removed, and, further, it will unscrew the top jet plug E, the regulating orifice D, and the resistance K. Not only so, but each screw plug is of a different size, so that the wrong one cannot be inserted in position. The float chamber can be opened by a mere twist of the lid. We have, therefore, an extraordinarily accessible carburetter complete in itself, which can be dismantled without any outside tools. Marketed by Mr. J. A. Ryley, 14½, Martineau Street, Birmingham.

No. 12.—The Brown and Barlow Carburetter.

A vertical throttle chamber contains a rotary sleeve valve, so ported that it brings into operation one after the other what amount to three separate and distinct carburetters. Two of these are placed side by side, and are provided, as shown, with different



The Brown and Barlow carburetter. The right hand sketch shows one of the jet chambers and its eccentric adjustment.

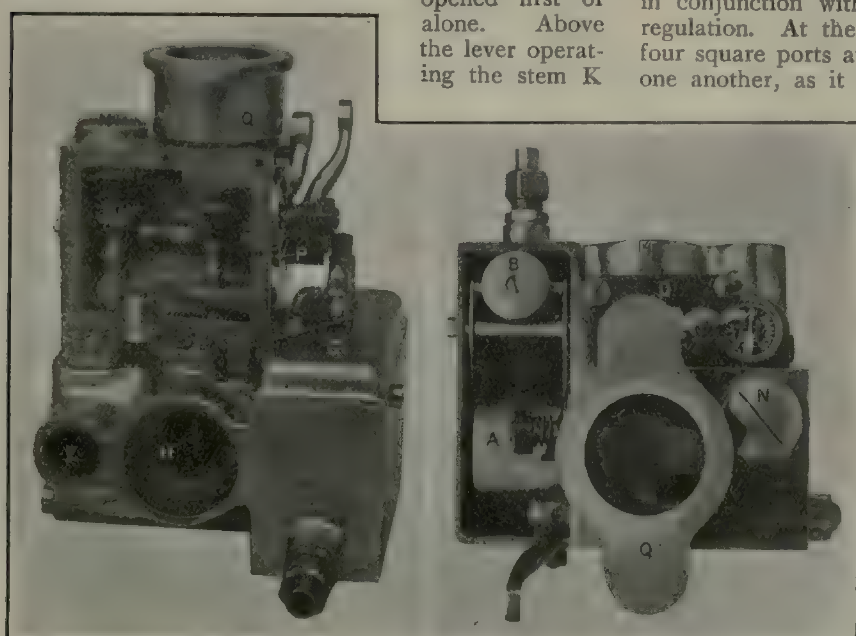
sized choke tube orifices, whilst the third is on the further side of the central chamber, and acts simply as a pilot jet for easy starting. In the little carburetters there are separate jets, which are controlled in size by an eccentric flange upon a vertical shaft,

which, terminating in a slotted head on the top of the mixing chamber, allows the finest adjustments of the size of these jets to be made whilst the engine is running. The sharp edge of the eccentric also enhances the atomising effect of the spirit. The best combination of jets for any particular purpose is, of course, very readily found by experiment. At the top of the throttle chamber is a flat automatic air valve, the action of which is governed by a simple form of dash-pot. Marketed by Brown and Barlow, Ltd., Westwood Road, Witton, Birmingham.

No. 13.—The Binks de Luxe Carburetter.

The float A is placed in the float chamber with its axis horizontal, being connected to the head of the needle valve B by means of the two hinged levers shown. The top of the float chamber C is provided with a spring-backed plunger for depressing the float for flooding when required, whilst the cover can be almost instantly removed by swinging to one side the flat spring D. Two jets are used, one a starting jet and the other for general running. The starting jet has its own air inlet E with a choke tube plug F, which can be rotated by slackening the wing nut G. Rotation of this plug has the effect of increasing or decreasing the area of the choke tube, the jet being concentric with the plug. The same arrangement applies to the normal running jet H. This has a choke tube of larger bore but of the same form, the milled head J being locked by the same wing-nut as the smaller choke tube.

Each jet and choke tube is provided with its own throttle valve of the mushroom type, the stems K and L being visible in the left-hand view. The main valve has an extension with a V cut in it, so as to ensure its being brought into use gradually. The stems are operated upon by levers on the spindle M, the lever acting on starting throttle K, having, however, a lead on the other so that the starting throttle can be opened first or alone. Above the lever operating the stem K is a valve N which can be opened to admit pure air to the engine when both throttle valves are closed, as when running downhill.



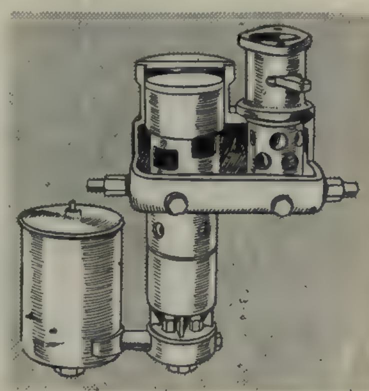
Two views of the Binks de Luxe carburetter. That on the left shows the mixing chamber with its cover plate removed, while the right-hand illustration is a plan view of the carburetter showing the float chamber with its lid removed.

A. Float.
B. Needle valve.
C. Float chamber cover.
D. Float chamber cover spring.
E. Air inlet to small jet.
F. Small choke tube plug.
G. Wing nut locking choke tube plugs.
H. Large jet.
J. Large choke tube plug.
K. Spindle of starting throttle valve.
L. Spindle of main throttle valve.
M. Throttle valve lever spindle.
N. Scavenging air valve.
P. Hand-operated extra air valve.
Q. Adjustable induction pipe flange.

The mixing chamber is shown in the left-hand view with its cover plate removed, this cover plate being held in position by eight small screws. It is not often necessary to remove it, but is easily detachable when required. On the right-hand side of the mixing chamber in the left-hand view will be seen a flat rotating valve P, which is merely an extra hand-controlled operated air valve. Marketed by C. Binks, Ltd., Eccles, Manchester.

No. 14.—The Smith Carburetter.

Petrol is led from the float chamber, which is of the ordinary needle-valve type, to a ring in which four separate jets are fixed, these jets being of different sizes. The jets are separated by two diametrical walls which divide the ring and its tube into four compartments, each of which has its air inlet at its base and forms a separate carburetter in itself. One of them, for the purpose of giving a rich mixture for starting, has a sharp constriction cast into its side to give a higher velocity to the air past the jet.



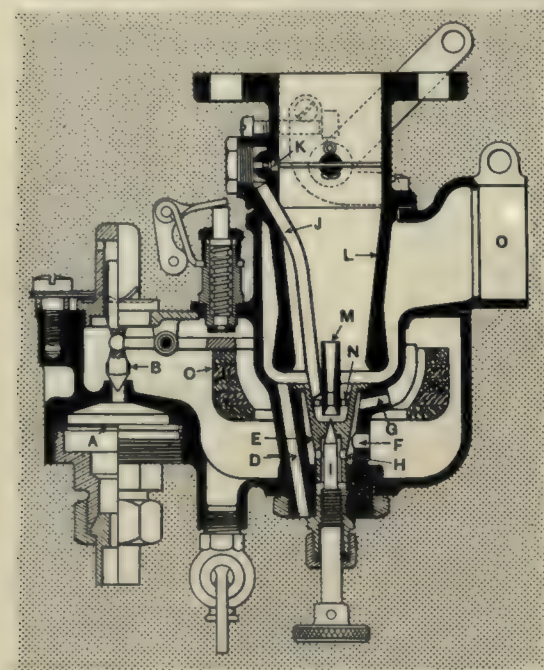
Part sectional view of Smith and Son's new four-jet carburetter.

Sliding on the outside of the quadruple choke tube is a sleeve which is perforated, and which furnishes in conjunction with ports in the tube an extra air regulation. At the top end of the choke tubes are four square ports at different heights and overlapping one another, as it were (this is clearly shown in the sketch), and each of these ports communicates with one choke tube. They are opened and shut by an annular piston which slides over the top of the tube inside a guide. The position of the piston is dependent purely and simply upon the suction of the engine. Beside the piston is a peculiar rotating type of throttle valve, and both these members are in communication with one another, being let into a hot water jacketed box which forms the body of the carburetter, where the mixture from the four sources unites. The multi-port throttle valve is designed to promote complete vaporisation of the mixture, and it may be remarked that it is placed in a different position in the racing type of carburetter. In this model the double right angle course which the mixture has to follow is considerably straightened out. Marketed by S. Smith and Sons, Ltd., 9, Strand, London, W.C.

Loose Carburetters.

No. 15.—The Holley Carburetter.

The jet E is formed in a cup-shaped chamber. When the engine is stationary the petrol level rises part of the way up this cup-shaped chamber to the foot of the starting tube J. It is, therefore, obvious that, if the butterfly throttle be opened a mere fraction,



A sectional view of the Holley carburetter.

A. Filter gauze.
B. Petrol inlet valve.
C. Float.
D. Petrol overflow in case of flooding.
E. Jet piece in cup-shaped chamber.
F. Petrol inlet to jet chamber from float chamber.
G. Air inlet to jet chamber.
H. Connection between jet and jet proper.
I. Needle valve to jet for regulating.
J. Starting tube.
K. Starting nozzle
L. Choke tube.
M. Mixer tube above jet.
N. Holes in base of M.
O. Main air inlet.

the engine, on being turned over, will suck a very rich mixture up J through K and will start. K, it should be mentioned, is made as a screw plug, and plugs of different sized orifice are applied, so that just the right quantity of petrol for starting the engine and running it dead slow can be provided by using the right sized plug. As soon as the engine has started and the throttle is opened more widely the petrol level in the cup drops, and the jet functions in the usual way. It will be seen that the orifice F connects the float chamber with the jet and it will not pass more than a given amount of petrol, so that when the demands of the engine for petrol become greater the level is automatically lowered, and the cup above the jet is no longer filled with petrol.

F, as shown in the drawing, has no method of adjustment, and none is required when carburetters are turned out for a given size of engine, but when it is desired to move a carburetter from engine to engine, or to make the same carburetter suit different sizes of engines, F can be provided with an adjustable plug like K, so that just the right size of orifice can be secured. This also provides means of adjustment should any great change in the viscosity of the fuel regularly used be made.

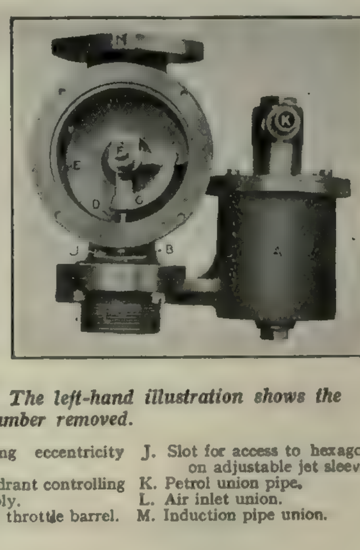
The jet itself can be adjusted by the needle valve I, so that just the correct aperture can be given, and, once given, the adjustment locked, but there is also another uncommon feature in the admission of air into the jet itself. It will be noticed that there is a channel G at the side of the jet chamber. This is an air passage between jet E, through H, and the float chamber into which air is admitted freely by small "breather" orifices, and the theory is that a small quantity of air passes through G and intermingles with the petrol coming through F to the jet. Above the jet there is a mixer tube, or funnel M, to assist in the atomisation of the petrol from the jet, which passes up it, some air being taken at N. The main principle of the carburetter is that the petrol orifice F from the float chamber to the jet is never subjected to suction but only to gravity, and can never pass more than a predetermined quantity of petrol in a given time. This is brought about by the air orifice G, as without this there would be a direct suction not only on the jet but on F. Marketed by Holley Bros., Ltd., 46, Northumberland Road, Coventry.

No. 16.—The Facile Carburetter.

By reference to the left hand illustration, which is a side view of the throttle chamber with cover removed, the rotary throttle E is seen within with the jet covered by the jet sleeve D passing through a circular hole in the body of the carburetter and through a specially shaped slot in the throttle ring. Mounted eccentrically on the throttle spindle is a quadrant G, the periphery of which passes over the top of the jet and is rotated with the throttle. Over the jet proper is screwed the adjustable jet sleeve D, in the crown of which an orifice of the proper diameter is bored, and through which the petrol sprays against the face of the quadrant. It is the distance at which the face of the quadrant is set from the flat crown of the jet sleeve that governs the quantity of petrol which can be drawn through the jet by the suction of the engine.

The jet proper has a thread cut upon it upon which the jet sleeve is screwed, this sleeve being capable of adjustment from outside by means of a spanner inserted through the slot J.

The eccentricity of the quadrant at the open position of the throttle, by which the height of its peri



Two aspects of the Facile carburetter. The left-hand illustration shows the throttle cover chamber removed.

A. Float chamber.
B. Neck of throttle chamber
C. Fixed jet.
D. Adjustable jet sleeve.
E. Throttle barrel.
F. Stud adjusting eccentricity of G.
G. Eccentric quadrant controlling petrol supply.
H. Air opening in throttle barrel.
J. Slot for access to hexagon on adjustable jet sleeve
K. Petrol union pipe.
L. Air inlet union.
M. Induction pipe union.

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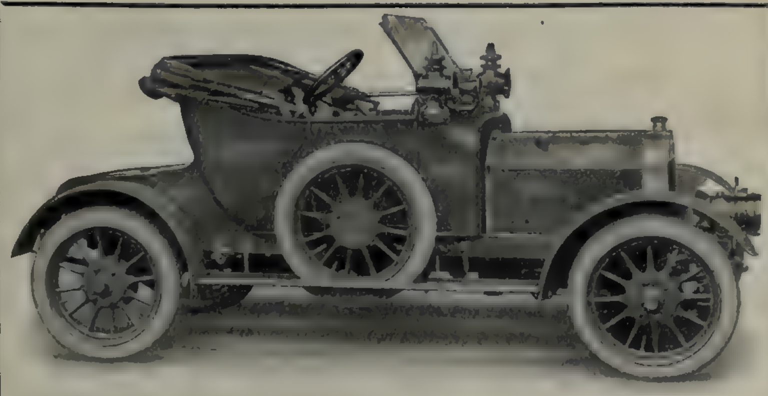

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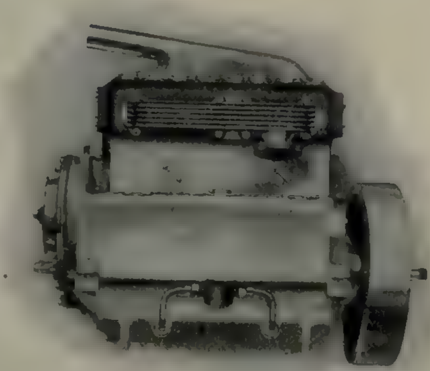

The Swift 10 h.p. Four-cylinder Engine. Note cleanness of design and easy accessibility of all parts. Aluminium plates enclosing valves are easily detachable. See complete list for other important features.

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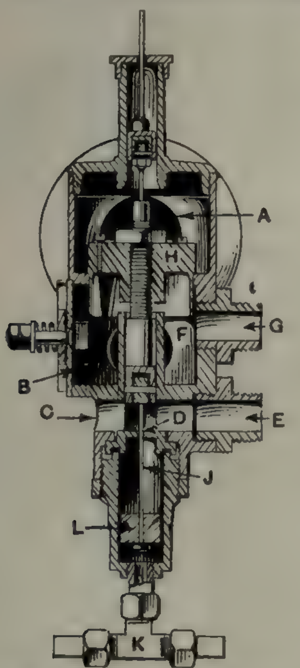
Loose Carburetters.

phery above the jet is set at the full throttle opening, can be adjusted at will, also from outside the apparatus by means of the stud F which projects through the cover. The throttle opening and the jet delivery being adjusted exactly at closed and open throttle positions while the engine is running, all the intermediate positions are consequently proportionate. Thus the carburetter has two independent settings, the slow speed for stationary running made by raising and lowering the jet sleeve with the small spanner operated through the slot J, while for power and high speed the adjustment is obtained by varying the eccentricity of the quadrant as suggested above.



Sectional view of the Stewart-Morris paraffin carburetter. The letters are referred to in the text.

The float feed chamber is attached to the neck of the throttle feed chamber in such a way that it can be fixed at any desirable angle thereto. Marketed by the Facile Carburetter Syndicate, Ltd., Jubilee Place, Chelsea, London, S.W.

No. 17.—The Stewart-Morris Paraffin Carburetter.

When the induction pipe throttle A is nearly shut (*i.e.*, for slow, light running), the auxiliary air throttle B, which is connected with it by a link, is completely shut, and all air passing to the engine is drawn in at C, whence, passing over the fuel orifice D, it passes on through E to the vaporiser.

The carburetted air from the vaporiser then re-enters the carburetter, passing into the mixing chamber F at G, and by lifting the valve H passes through the throttle to the engine. An adjustable tapered needle J working in the fuel orifice D is attached to the valve H, the vertical movement of which, therefore, controls the amount of fuel which is allowed to mix with the air passing in from C. When the throttle is further opened the auxiliary air throttle B is also opened, and still further air can be allowed to enter the mixing chamber F by a hand controlled valve not shown in the sectional illustration.

No float chamber is used, the fuel (either paraffin or petrol) entering at K. Marketed by the Stewart-Precision Carburetter Co., Ltd., 199, Piccadilly, London, W.

No. 18.—The Binks Petrol-paraffin Carburetter.

In this carburetter two float chambers A and B are provided. A is fed from the petrol tank and B from the paraffin tank. These two tanks could be combined, one division representing 20% for petrol, the remaining 80% of space being occupied by paraffin, which may be of quite a low grade.

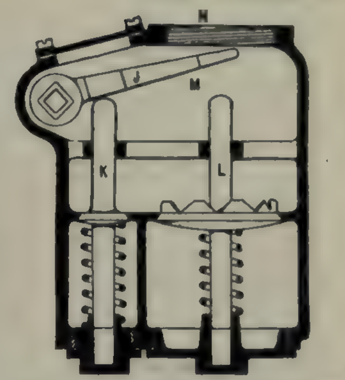
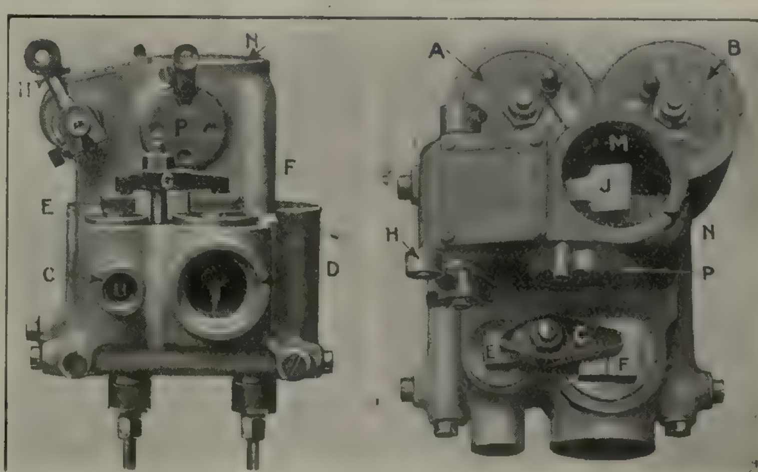


Fig. 1.—Sectional view of the throttle and mixing chambers of the Binks petrol-paraffin carburetter.

J. Throttle operating lever.
K. Petrol throttle valve.
L. Paraffin throttle valve.
M. Mixing chamber.
N. Outlet to vaporiser and induction pipe.

The petrol float chamber A is connected by the usual leads within the carburetter casting to a small jet, the end of which stands up within the air passage C, surrounded by a choke tube E. The paraffin, on the other hand, is conveyed from the float chamber B by a duct to the main jet within the main air passage D, with a similar but larger choke tube F. Both choke tubes are readily adjustable by slacking the nut which holds down the double dog G.

When it is desired to start an engine fitted with this carburetter, the throttle lever is opened a little way only, which has the effect of opening the small throttle valve K, fig. 1, without moving the main throttle valve L. Both these valves are of the inverted mushroom type, and are held up against their seatings by springs. The small valve K is that regulating the petrol gas supply, whilst L controls a supply of paraffin vapour. Therefore when, as mentioned, the valve K alone is opened the engine is supplied only with petrol vapour and air, which passes through the mixing chamber M and thence to the induction pipe by way of the outlet N. Attached to the latter outlet is an exhaust heated vaporiser which shall be described later, and after the engine has been running a short while the vaporiser becomes heated and the paraffin may be brought into use by the throttle being opened further. The end of the lever J will then bear upon the top of the valve L, so opening the latter and admitting to the engine paraffin vapour and air, which meeting the petrol mixture in the mixture chamber M, passes with it through the



Figs. 2 and 3.—Two views of the Binks petrol-paraffin carburetter.

A. Petrol float chamber.
B. Paraffin float chamber.
C. Air inlet to petrol jet.
D. Main air inlet past paraffin jet.
E. Small choke tube surrounding petrol jet.
F. Main choke tube surrounding paraffin jet.
G. Dog piece securing choke tubes
H. Throttle control lever.
J. Throttle operating lever within mixing chamber.
M. Mixing chamber.
N. Outlet to vaporiser and induction pipe.
P. Hand-operated additional air valve.

vaporiser and thence to the engine. It will thus be seen that when the engine is pulling with the throttle more than halfway open both petrol and paraffin form the fuels, but the wider the throttle is opened the greater the proportion of paraffin to petrol, until with full throttle 80% paraffin is being used. Marketed by C. Binks, Ltd., Eccles, Manchester.

No. 19.—The G.C. Paraffin Gas Producer.

This carburetter itself is in appearance like a silencer, and in point of fact displaces the silencer entirely on a car to which it is fitted. From the paraffin tank the oil passes through a float chamber, and a needle valve with a sight glass in front of the drip, and thence to the carburetter. In the carburetter the oil flows from a perforated pipe, and is heated to a gas at a very high temperature by being spread over a large area of special packing in the carburetter; the latter also contains several expansion chambers for the exhaust gases of the engine, so acting also as a silencer. At the

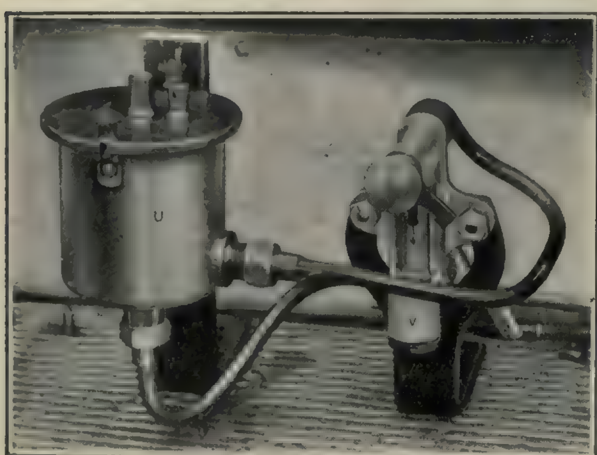


Fig. 1.—The float-feed chamber U and the needle-valve V for the paraffin supply. The pipe F leads the paraffin to the carburetter.

same time as the engine draws this highly heated paraffin gas from the carburetter it also draws, mixed with it, a considerable volume of air. This mixture of air and gasified paraffin (vaporised paraffin in fact), still at a high temperature, is led through a jacketed pipe at high velocity to an ordinary three-way plug cock carried on the induction pipe. On passing through the cock to the induction pipe air is drawn in, which has the effect of cooling and diluting the rich paraffin gas, so that a full charge is drawn into the cylinders, diluted to the correct richness.

The whole attachment consists of a silencer-like carburetter (which displaces the ordinary silencer), a paraffin tank, a float chamber, needle valve, and three-way cock with control lever. All these may be fitted independently of the existing petrol carburetting apparatus and its control gear.

Fig. 1 shows the paraffin float chamber, through which the fuel passes to the drip-feed on the right of the illustration. From this drip-feed the paraffin is drawn by the engine suction to the carburetter, which also acts as a silencer for the exhaust gases. The carburetter is shown in section in fig. 2. In this A is the inlet through which the exhaust gases from the engine pass along the tube B to expand in the chamber C and thence to pass into the chamber D, and from there into the atmosphere through the outlet E. Paraffin from the drip-feed regulator enters at F and passes along the perforated pipe G and its enveloping tube H, which is also perforated. From these tubes

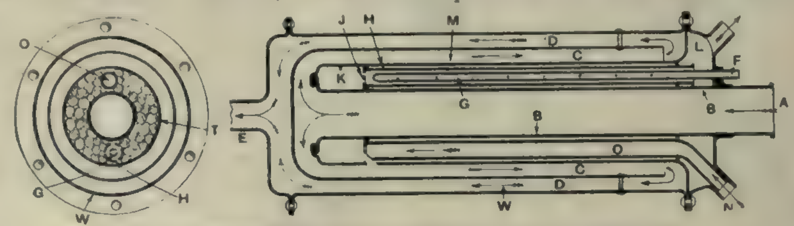


Fig. 2.—Longitudinal and cross sections of the G.C. carburetter.

A. Exhaust inlet.
B. Exhaust pipe.
C D. Exhaust expansion chambers.
E. Exhaust outlet.
F. Paraffin inlet.
G Perforated paraffin sprinkler.
H. Perforated protecting pipe for G.
J. Perforated partition to collecting chamber K.
K. Gas collecting chamber.
L Paraffin gas outlet pipe.
M. Casing round gas collecting chamber.
N. Air intake.
O. Air heating pipe.
T. Porous packing, heated by proximity of exhausted gases, over which the paraffin spreads, and from which it is evaporated and subsequently gasified.
W. Outer casing of carburetter.

the paraffin is distributed over the packing T through which it percolates, thereby becoming rapidly heated and gasified. The suction of the engine in the induction pipe L draws the gasified paraffin into the chamber K, where it mixes with the air drawn in at N and heated in the tube O, the mixture passing to the induction pipe L inside the casing M.

After leaving the carburetter by the pipe L the gas is led to a three-way cock. On the tap being opened the suction of the engine draws extra air in at an orifice, which cool air meets the hot air vaporised paraffin from L and cools and dilutes it so that it enters the engine in a state suitable for combustion in the ordinary manner.

It should be added that the engine is started up on petrol; after five minutes running on petrol, to warm the engine up the paraffin-tap is turned on and it then runs solely on the latter fuel. Marketed by the British and Colonial G. C. Syndicate, Ltd., 11, Hart Street, Bloomsbury, London, W.C.

No. 20.—The H.P. Carburetter.

This carburetter has three jets, all three in line with the passage to the induction pipe and each surrounded

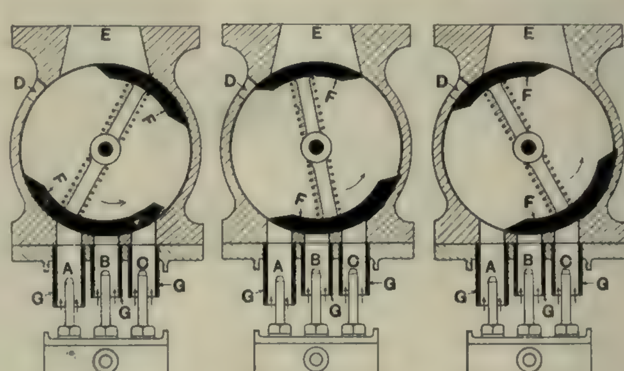


Fig. a. *Fig. b.* *Fig. c.*

by an air intake tube G, a spring loaded throttle block F being inserted in the induction pipe above the jets. The action is extremely simple, and is as follows:

Fig. *a* shows the throttle block in such a position that all three jets, A, B, and C, are shut off and the pure air port D open so that pure air may pass directly into the engine.

Fig. *b* shows the throttle block in such a position that all three jets are still shut off and pure air prevented from passing into the induction pipe. Fig. *c* shows the first jet A in operation by the rotation of the throttle block F to the position shown, and in fig. *d* jet B is also opened, while fig. *e* shows all three jets

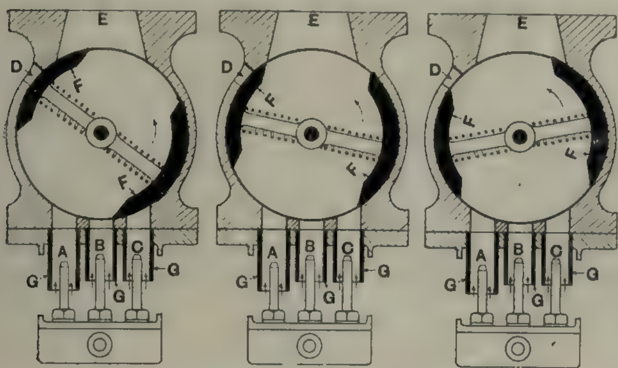


Fig. d. *Fig. e.* *Fig. f.*

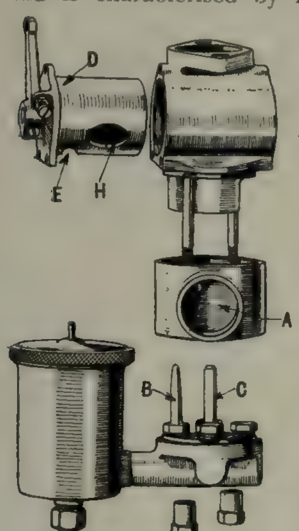
The H.P. carburetter shown in vertical section in each of its six main positions.

A B C. Jets. D. Pure air port. E. Induction pipe. F. Throttle block. G G G. Air intake or choke tube.

fully opened and the throttle opening to the induction pipe fully open also. A still further movement of the throttle block to the position shown in fig. *f* allows extra air to be admitted through the pure air port D. Marketed by Henry Garner, Ltd., Moseley Motor Works, Birmingham.

No. 21.—The Garner Carburetter.

The Garner carburetter is of the two-jet variety, and is characterised by its extreme simplicity. Air enters at a port A below the jets B and C, and passes through choke tubes the size of which may be set to suit different engines. The gas is then controlled by a barrel throttle D which determines the amount of mixture to pass into the cylinder. Circular ports E and H are cut in the barrel to correspond with the choke tubes, and are so arranged that first the small jet B only is in operation. Then, as the main and larger jet C and air supply are opened up the small jet is shut off. The Garner carburetter is light and small, and is adaptable to almost any engine. Marketed by Henry Garner, Ltd., Moseley Motor Works, Birmingham.

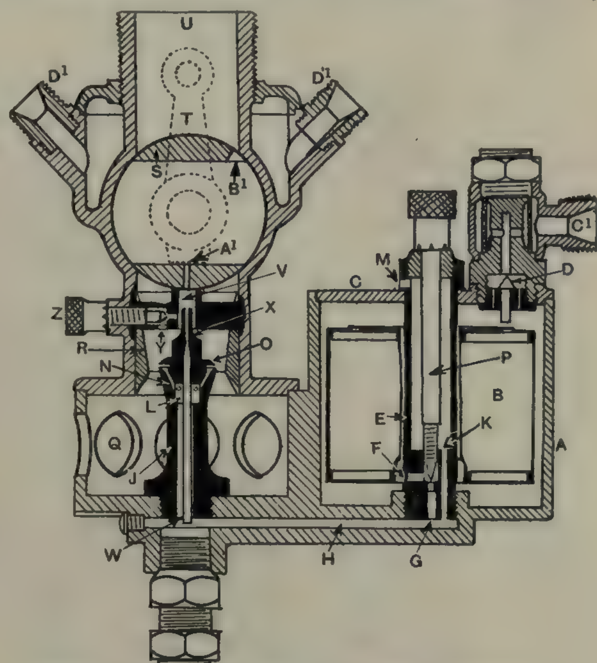


The Garner two-jet carburetter. The letters are referred to in the accompanying text.

No. 22.—The Longuemare Carburetter.

When the throttle S is closed the quantity of fuel required to keep the engine slowly turning over is very small—less than that which flows into G and H. The surplus therefore rises in the column E through the hole K to the normal level in the float chamber. With the throttle shut, or, rather, in the slow running position, the petrol is drawn up the tube W to the jet X, the head of which is enveloped in a small choke tube V, air being drawn in through Y, the mixture passing to the engine through the pilot holes A1 and B1 in the throttle block.

Sudden opening of the throttle S cuts off the slow running jet X and its choke V, owing to the peculiar form of the throttle S, air being now drawn through the main choke R from the air inlets Q, and petrol from the rose jet N, below which is a reserve of petrol easily drawn by the engine from the chamber L, which again is rapidly replenished by the column of petrol in the pillar E through the passages K and H. However, the demands of the engine have now reached a pitch with which the orifice G cannot cope, consequently there is no surplus to pass up K to form a reserve column. In fact, the converse happens; the demand in the passage H is so great that, besides drawing petrol from G, air is also drawn from M, down E and through K, and, together with the petrol, emerges at the sprayer N, where it impinges on the



Section of the model F.B. Longuemare carburetter.

A. Float chamber.
B. Float.
C. Float chamber cover.
D. Constant level float valve.
E. Compensating column.
F. Petrol orifices.
G. Petrol orifice.
H. Petrol channel.
J. Jet column.
K. Air or petrol holes.
L. Petrol chamber.
M. Air holes.
N. Main mixture exits.
O. Deflector.
P. Petrol supply adjusting valve.
Q. Main air inlets.
R. Choke tube.
S. Throttle.
T. Throttle lever.
U. Outlet to engine.
V. Slow running choke.
W. Slow running petrol supply tube.
X. Slow running jet.
Y. Slow running air inlets.
Z. Slow running adjustment screw.
A1. B1. Holes in throttle for mixture for slow running.
C1. Petrol supply.
D1. Hot jacket connections.

plate O, from which it rebounds horizontally, and is met by the upward draught of air through the choke R, and carried through the throttle block to the induction pipe U to the engine. Further movement of the throttle again uncovers the jet X, and so an unrestricted flow is provided for the air from the inlets Q to the induction pipe U, except for the bridge carrying the pilot choke V. Sold by E. J. Hardy and Co., Ltd., Queen Victoria Road, Coventry.

Lubricating Systems.

A Review of Existing Methods of Maintaining the Oil Feed to the Engine Bearings.

THE engine, it is obvious enough, is the heart of an automobile, and it is no less true that the heart of the engine is its lubrication system. The ignition may fail and cause a temporary stoppage. The carburation may be upset by some extraneous cause and produce a loss in efficiency. But if the lubrication go wrong not only will there be a loss in efficiency terminating in a stoppage altogether, but it is more than likely that serious damage will be done to vital parts. This being the case, it is somewhat surprising to find *(tot homines, quot sententiæ)* that there are almost as many varieties of lubricating systems as there are designers of motor cars. They, however, lend themselves to grouping readily under a few main classifications, though they differ from one another in a great many minor and sometimes important details. As set out hereafter, these classifications are primarily three in number, the completely positive system, the partially positive, and what may be described as the "incidental." In other words, there is the system in which the oil is directly forced to every moving part, secondly the system in which it is forced to some moving parts and splashed on to others, and thirdly the system in which the oil is splashed on to all parts.

On *prima facie* grounds one is justified in saying that only the first of these systems is, practically speaking, applicable to the ideal car, but automobile design, like every other branch of engineering, is built up out of an infinite number of compromises, and hence there may be some difference between what is theoretically perfect and what is practically expedient. One of the chief difficulties of motor car construction is to arrange matters so that economy is served no less than efficiency. The loose tongued often make these two terms interchangeable, being led away by appearances, but as a matter of fact they are extremely distinct. Indeed, it is almost a truism to say that efficiency can always be improved at the expense of economy, provided that the latter term be made, as it should be, to embrace a consideration of the whole and not merely of a part. Automobile economy is, it must be remembered, something more than mere fuel consumption. To take a case in point. Where a factory is driven by a steam plant, efficiency of this plant (in terms of horse-power developed per unit weight of fuel) may be increased by the use of some special form of device which regains part of the heat which is otherwise wasted up the chimney. But if this device cost £1,000 to install and only saves five tons of coal a year, then it is clear that it regains less than it loses, and is, therefore, not economical, though it is none the less efficient.

It is exactly the same with lubricating systems. Of two lubricating systems, of which A costs £30 to install and uses one gallon of oil per thousand miles, whilst B costs £15 to install and uses a gallon and a quarter of oil per thousand miles, it is obvious that A is the more efficient, while B is the more economical always provided that both work in practice sufficiently well to allow the engine a life commensurate with that of other parts of the car.

The probability is that if a car's useful life were expected to be, say, a hundred years, there would be no division amongst designers' opinion as to which was the more desirable principle of lubrication to adopt. As it is, other important questions enter into the matter. Simplicity, and Ease and Cheapness of Accurate Production, and Understandableness, are points which are driven home by competition in the open market, and hence it is only natural to find these considerations modifying the theoretical idea of perfection. It is not intended to be suggested by this that any reputable motor car manufacturer would deliberately sacrifice either efficiency or economy to decrease his cost of production. On the other hand, the difference between "Perfection" and "Nearly Perfection," whilst being obvious enough on a balance sheet, may never make its presence felt in a car's actual running. This, then, is the fundamental compromise which lies at the root of car design.

The pros and cons of the two main systems are as follows, the intermediate system, which is partially mechanical and partially splash, partaking to a certain extent of their advantages and disadvantages.

Positive System.

The great advantage is that, provided there be a sufficient pressure behind the oil supply, lubrication will be forced to every working part. It might be thought that one difficulty in design contained in this system would be the proportioning of the various oil orifices which lead to the cylinder walls, gudgeon pin, big end bearings, and main crankshaft journals. This, however, is not the case, it only being necessary to make certain that the piston, which is, as it were, the terminus of the line, is receiving a definite amount of lubricant, when the other bearings can be flooded to a considerable extent without doing any harm. There is, however, a limit to this flooding, for a good proportion of the excess flowing from the big end bearings will be flung on to the cylinder walls and the latter consequently over-oiled. The principal difficulty is that the crankshaft must be hollow practically throughout its length, and that to provide a sufficiently easy flow the internal leads must be of fairly large diameter. Great care must also be taken in plugging the ends of these ducts on the crankshaft webs that the weight of the plugs is uniform, otherwise the crankshaft is slightly thrown out of balance. The certainty with which the oil is forced along the crankshaft and up the connecting rod to the gudgeon pin and piston depends to a considerable extent upon the tightness of the big end and main bearings. If these become slack then the feed to the gudgeon pin is lessened by the amount that they allow to leak past, hence wear in a big end bearing may, with this system, reduce beyond the safety limit the amount of oil delivered to the piston. In fact, as the system is usually arranged, the presence of one slack main bearing can affect the wear of all the other bearings unless due notice be taken of it and the feed pressure increased. Providing this be high enough an oil film between the surfaces can practically be ensured under all conditions of load, and it is for this reason that when properly carried out the positive principle is capable of giving such excellent results. It cannot be denied, however, that it is expensive to install, and a considerable amount of work has to be done on parts which require to be accurately balanced.

Splash System.

The splash system is, of course, simplicity itself, and by requiring a minimum amount of internal piping and no internal work to be done whatever upon balanced rotating parts this is naturally the system which makes best for cheap and rapid production. It has also been abundantly proved that when intelligently designed it gives remarkably good results. Its disadvantages are primarily that the flow to the bearings being by gravity the oil film between working surfaces is liable to be destroyed under heavy loads. This difficulty can, of course, be overcome almost completely by the use of properly designed distributing ducts in the bearings. A secondary disadvantage arising out of the first is that if a particle of foreign matter be accidentally allowed to enter the oil circulation it may seriously affect its working, whereas with a sufficiency of pressure behind it such matter would, of course, be blown out of the way, hence in a great many cases this splash system is modified by a positive feed through the main bearings and big ends, as these parts are the most easily damaged by a cessation of the supply of lubricant.

One disadvantage of the splash system is that oil is not flung uniformly on to the cylinder walls, but in fact is distributed in what is the direct converse of the desired manner. If the engine run clockwise more oil is thrown by the connecting rod on to the right hand cylinder wall than on to the left, the latter being, of course, near tangential to the path of the big end. It is, however, this left hand wall which resists the thrust of the piston due to the angularity of the connecting rod, and hence the oil is not directed to that side of the piston and cylinder which is under the greatest load. Much the same may, however, be said of the positive system if the oil be fed to the cylinder walls simply through the hollow gudgeon pin, for in this case, too, the oil is led to the slack side instead of the tight side. It has sometimes been stated that this is correct in principle, being exactly analogous to the case of the journal bearing in which as every apprentice knows, lubrication must be fed in at the slack side. Such an analogy is, however, quite erroneous, since the piston does not rotate, and hence has no tendency in itself to maintain an unbroken oil film around it.

Feed.

There are at present three systems of feed in use, namely:

1. Feed by time. (This at one time enjoyed considerable popularity, but is now only found on the cheapest of cars.)
2. Feed relative to the speed of the engine. (This principle greatly preponderates at the present time.)
3. Feed proportional to the load. (This has only comparatively recently been introduced, and is at present in a very small minority.)

There can be no two opinions as to which of these three is the best. Whilst the last one is right, the other two are almost equally wrong. Feed by time generally takes the form of a visible drip actuated either by low exhaust pressure or by gravity. If the feed be adjusted to give a definite number of drops per minute, then the lubrication remains the same whether the engine ticks round idly or runs at full throttle under load. The feed of oil is thus alternately insufficient and excessive according to the nature of the load against which the engine has to pull. The average load will, of course, under ordinary running remain fairly constant, and hence, in the end, such a feed will come out more or less right. But, on the other hand, it is never *actually* right except at such moments as the engine is running under some specific load. For all other loads it must invariably be wrong.

Much the same remarks apply to the second system, in which a pump is used driven by the engine, and accordingly delivering a volume of oil which varies per unit of time with the engine speed. At the same time it possesses an enormous advantage over the drip feed in that the oil is subject to a practicable pressure. None the less, it fails to an exactly equal extent in giving alternately too much and too little oil according to circumstances.

Let it be supposed that the oil delivered is exactly correct when the car is running at twenty miles an hour on a perfectly level road, then it is obvious that the oil supply will be increased when the car is running down a gradient at thirty miles an hour, and that if no change in gear be made the supply in lubrication will be decreased when it is running fifteen miles an hour up a gradient. This, of course, is exactly the reverse of what should be the case, because at thirty miles an hour downhill the engine would probably be working under a much lighter load than when it is pulling the car fifteen miles an hour uphill, hence at this thirty miles an hour it will require less oil than at the slower speed uphill. In other words, the feed proportionate to engine speed would only be correct provided that the load also was always proportional to the engine speed, whereas, of course, such is not the case under ordinary running, although in the end the two features will probably average out tolerably equal. It is this fact which causes most engines to smoke.

On a slightly down gradient or on the level with the wind behind one, a mere whiff of gas will maintain a car at a fairly high speed, and in these circumstances the engine load is exceedingly light whilst the supply of oil is comparatively heavy. The cylinder walls, therefore, get over-lubricated, with the result that smoking occurs. These several disadvantages are all obviated by making an oil feed proportionate neither to time nor to speed, but to load. This can be done in several ways, three of which are detailed hereafter, viz., the Rolls-Royce, Daimler, and Panhard. In every case the mechanism necessary is extremely simple.

Types of Pump.

Opinions of designers appear to be fairly equally divided as to which is the better type of pump to use for maintaining the oil circulation. At present a gear pump with two pinions running in mesh with one another appears to preponderate, though a direct-acting or plunger pump is apparently increasing in vogue. This certainly is due to the fact that the advantages of a high pressure system are becoming more and more realised, and for this the piston type of pump is superior to the pinion type, as the latter can only pump against comparatively low pressures, and in addition it cannot lift to such an extent as the plunger type. Both, however, suffer to different extents from the same disadvantages, namely, that unless submerged in the oil supply they require priming before they will work satisfactorily, the piston pump being admittedly better than its rival in this respect. For this reason, one frequently finds them located at the lowest part of the engine, where, provided there be any oil at all in the sump, they are sure to be "drowned," although it by no means follows that this is the most convenient place they could occupy.

Filters.

In general, one of the points at which criticisms can be levelled in lubrication systems is the absence or paucity of filters. In our opinion, it is a most important matter that oil, whether constantly circulating or not, should be maintained as free from foreign matter as possible. It is, in fact, almost inconceivable that one could have too many filters introduced into a system. If the objection be made that they are liable to clog up, and in doing so require frequent cleansing and attention, this is clear proof that their presence is beneficial. If a filter be used, and if after months—one may almost say years—of work it does not clog up, this may be taken as an indication that it is superfluous, but a lubrication system in which this would happen is scarcely to be imagined. It is not merely enough to filter the oil when pouring it into whatever form of containing vessel is used from which the oil is subsequently drawn. When oil is being worked between wearing surfaces it rapidly loses its lubricating qualities, not so much because these are destroyed by heat or by any internal change of a chemical nature, but because the oil gets filled with very small fragments of metal in a state of suspension. Before the used oil is replaced into circulation it is therefore advisable that these particles of metal should be removed, which can obviously only be done by very careful and complete filtering. It may be urged that if the bearings are kept flooded by lubricant little harm can result in the fact of these metallic particles being present, but this view is scarcely tenable when subjected to careful consideration. Lubrication is only effective when an unbroken film of oil lies between the working surfaces. Whatever the load on these surfaces be, within reason, the oil film is not destroyed provided it be maintained at sufficient pressure. Failure in the oil film may easily be brought about by an accumulation of small particles of metal, which produce a metallic contact between the working surfaces, and, secondly, set up an unnecessary increase of friction. It is for this reason that a positive high pressure oiling system has so much to commend it. A high pressure in itself is almost sufficient to ensure that no such collection of particles can form in ordinary circumstances, and not only so, but, given sufficient pressure, the oil can be forced through filters capable of almost entirely removing the impurities which have gathered in the course of circulation. If this be not done (and a great deal more care might be exercised in this respect) the conditions are practically analogous to a laundress having only a single bucket of water for a week's washing, adding, we will suppose, a few drops of fresh water at intervals to make up for loss by evaporation and what was carried away by the clothes themselves.

In some cases filters of exceptionable size and number are used, but there is a common and a bad tendency to make them much too large in mesh. It appears that in some cases the function of the filter has been conceived to be that of arresting such things as bolts, nuts, etc., that may get thrown around inside the engine. Attention is rarely given to the importance of making the mesh small enough to catch the much more subtle smaller fry which are none the less capable of doing a lot of damage.

The ideal system should contain first of all a filter of medium mesh in the filler cap, secondly a filter of fine mesh between the oil supply and the suction valve of the pump, thirdly an extremely fine filter of some such material as thin felt between the pump delivery and the bearing surfaces. This means that the oil is progressively filtered on each circuit. Impurities will, however, be deposited wherever the used oil has a chance to collect, and the bottom of the crank chamber should therefore be formed of a shape which will encourage such impurities to precipitate themselves into a readily detachable trap by means of which they can from time to time be removed. It is of extreme importance that all the filters be made as accessible as possible. Cleaning them out is not an inviting job either to the chauffeur or an owner-driver, and it is made no pleasanter if half the engine has to be taken down before this performance can be successfully completed All filters should also be large in diameter, so as to be capable of working for a long time without the liability of clogging up. If a felt or other fabric diaphragm be used it should be arranged so as to be thrown away and a new one inserted from time to time.

Indicators.

Four types of indicators are in general use by means of which proper working of the oiling system can be ascertained. All are fairly equal in popularity, though if anything the commonest is the plunger type. This consists of a small cylinder introduced either into the direct oil circulating pipe coming from the pump or into a separate by-pass pipe. This cylinder contains a plunger normally held down by a spring, and carrying externally a visible head piece which shows at a glance if there be any pressure in the circulating system or not. Immediately this fails the spring returns the piston and its tell-tale head to a position which is obviously different from that which it occupies normally. The advantage of this type of indicator is that when it cannot be seen its evidence can be obtained through sense of touch.

The second type is the ordinary pressure gauge or manometer, which, of course, requires some artificial illumination to make it of any use at night. On the other hand its reading is informative, since it shows at a glance not only whether the oil is circulating or not but the manner in which it is circulating also. The drip indicator performs much the same office as the pressure gauge, enjoying the advantage of showing how the pump is working. It sometimes provides a ready means by which small adjustments can be accurately made. Its disadvantage is, however, that in time the glass is liable to get clouded and that even at the best of times it is not very easy to see and gauge the oil flow. The fourth type of tell-tale is a rotary one, consisting practically of a light free-running form of gear pump, the pinions of which are placed under a glass lid so that they can be seen revolving in the flow of oil.

Position of Oil Vessel.

In the great majority of chassis the supply of oil is intended to be carried in the sump formed in the lower half of the crank chamber; in which case some form of gauge is used, generally consisting of maximum and minimum run-off cocks, placed so as to be easily get-at-able. The amount of oil thus carried varies considerably in different engines. In some cases the volume of the sump has been cut down to rather a low capacity, so that it requires replenishing considerably more frequently than the petrol tank. This is rather a mistake, as filling up with oil is necessarily at the best of times a somewhat messy job, and no possible harm can be done when designing a sump to make this a matter of weekly rather than daily attention. The oil supply on some cars is carried on the dashboard, in others on the engine in a box attached either to the side of the crank chamber or to the

cylinders, and in still others in a tank attached to the side of the frame. Somewhere underneath the bonnet is, however, clearly the best place, because the temperature is there much more equable than in the outer atmosphere—a matter of little importance during threequarters of the year, but by no means negligible in winter, especially when the pump has lost some of its efficiency through wear.

Arrangement of Piping.

It does not appear to have yet been decided which is to be preferred, internal cast-in ducts or external piping. On the score of appearance (or rather, disappearance), freedom from the ill-effects of vibration, simplicity, and cheapness, there is much to be said for the first-named arrangement. On the other hand, it may easily be argued that these ducts may lead to weaknesses in the crank chamber casting, as well as being difficult to get at in case of accidental stoppage, to which their roughness and necessarily sharp angles make them more liable than pipes. There is no doubt that in a good many cases they give trouble in the foundry, for a three-eighth inch diameter core running the whole length of a six-cylinder crank chamber requires considerable art in manipulation. There may often also be some slight difficulty in clearing such cast-in ducts of foundry sand, quite a little of which is of course capable of doing considerable harm when eventually moved along by the oil circulation. One great advantage of the external pipe system is that in the event of there being any doubt as to whether there is a stoppage in the circuit the undoing of a union whilst the engine is running will speedily put such doubts at rest, whilst, in the event of foreign matter causing obstruction, detachment of the pipe and cleaning it out should be matters of a few moments only.

Individual Systems Described.—Section I. Purely Mechanical.

The black lines in the diagram fig. 1 (which represents no particular engine) indicate the circulation of oil in the general type.

Delaunay-Belleville.

The base of the crank chamber is formed into an inclined sump, at the rear end of which is a direct acting oscillating plunger pump driven off the camshaft. The cylinder of the pump is so mounted on its trunnion that it forms its own valve with the trunnion housing. The pump delivers through a detachable filter attached to the side of the crank chamber into a duct cast in with the base, from which pipes branch to the camshaft and crankshaft bearings. Both the crank pins and the connecting rods are hollow, and the oil is therefore forced direct to the big ends and also to the hollow gudgeon pins, out of which it flows on to the cylinder walls. These are also lubricated from the excess of oil thrown up from the big ends of the connecting rods. Incorporated in the filter is a relief valve which, when the pressure rises to a pre-determined amount, allows the superfluous oil to be returned to the sump. A pressure gauge fitted to the dashboard shows how the circulation is proceeding.

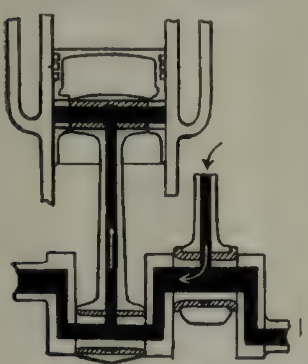


Fig. 1.—Diagram of scheme of oil-feed in positive lubrication.

Lanchester.

Contained in the crank chamber is a skew gear driven pinion pump actuated by a phosphor bronze ring carried on the flywheel end of the crankshaft. Oil is drawn through a filter from the inclined sump below the base chamber, and is delivered direct through a long external pipe to the seven main bearings of the crankshaft, which is hollow. Thence the oil is forced to the big ends, from which it passes to the hollow gudgeon pin and to the cylinder walls through a hole drilled in the connecting rod. The oil supply is carried in the crank chamber sump. A piston type of tell-tale, which rises when the engine starts, is fitted to the driver's control plate. The sump is provided with an oil level cock. A special feature of the Lanchester system is the high pressure of the circulation, which is about 40 lbs. when the engine is running at normal speed. A blow-off valve is used to prevent the oil pressure rising to an excessive degree.

Maudslay.

The crank chamber sump, which contains the supply of oil poured into it through one of the eight large crank chamber manholes, is divided by a transverse partition into two compartments, from each of which oil is drawn by a pinion pump driven by an extension of the camshaft vertical drive. Oil is delivered direct to all the main bearings, and thence through the hollow crankshaft to the big ends, after which it passes up the tubular connecting rods and so to the gudgeon pins. The cylinder walls are lubricated by the excess of oil which flows down the inside walls of the piston. No filter is used in the system, as the pump draws from a point some distance above the bottom of the sump, and the latter is provided with draw-off plugs. A plunger type tell-tale on the dashboard indicates the working of the system.

Metallurgique.

A vane or paddle pump, driven from the front end of the crankshaft, draws oil through a filter from the crank chamber sump wherein the supply is contained, and forces it to an oil pressure gauge on the dashboard and also to a distributer pipe leading to the three main crankshaft bearings. It then reaches the big ends through diagonal ducts drilled in the crank webs, and passes thence to the gudgeon pin bearings through light copper tubes carried in the channel of the connecting rods. The lubrication of the cylinder walls is effected by the throwing up of the excess of oil from the big end bearings. A float indicates the level of supply in the sump.

Rolls-Royce.

A gear pump placed at the bottom of the crank chamber sump is driven by the lower end of the vertical shaft which actuates the high-tension distributer of the coil and accumulator ignition system. This pump draws oil through a filter and discharges it to the three main bearings, viz., at each end and in the middle of the crankshaft, which is hollow. Through the internal channels the oil is forced to the big end bearings and to the smaller intermediate bearings of the crankshaft. The connecting rods carry small copper pipes which lie in the channel at one side, and oil makes its way through these pipes to the gudgeon pin and the cylinder walls. The oil pump is provided with means of adjustment whereby the pressure may be regulated from 1 lb. to 20 lbs. per sq. in., which is registered

Lubricating Systems.

on a pressure gauge on the dashboard. One of the special features of the Rolls-Royce system is the fact that within certain limits the oiling of the cylinder walls is proportional to the load. A patented form of valve is brought into operation by the accelerator pedal when the latter is moved through about two-thirds of its stroke, and directs an additional supply of oil through outside piping to the thrust wall of each cylinder. In addition to that contained in the sump, a supply of oil is carried in a tank attached to the side of the frame, from which the sump can be replenished when necessary.

Iris (25 h.p. and 35 h.p. Models).

These cars have a system similar to that of the Rolls-Royce, with the exception of the automatic control.

Section II. Semi-Mechanical.

There are two principles in common use, and this section may therefore be sub-divided into systems which employ a mechanical feed both to the main bearings and the big end bearings, the rest being lubricated by splash, and those in which only the main bearings are positively fed.

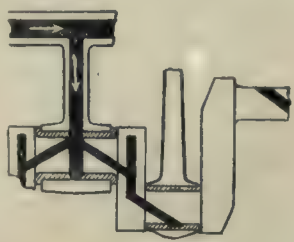


Fig. 2.—A typical system of semi-mechanical oil-feed; the solid black and the arrows indicate the oil flow.

Adler.

Bolted to the side of the sump below the crank chamber in which the oil is contained is a casing containing two gear pumps driven by a vertical shaft skew-geared to the camshaft. The two pumps are of different sizes, and are placed one above the other. The function of the upper one is to supply a sight feed indicator on the dashboard which is of the visible drip type. It contains in addition, however, a simple type of piston valve, by means of which from time to time the supply of oil may be directed to the main universal joint of the cardan-shaft. In normal circumstances the delivery of the larger pump, and also the outflow from the sight feed, is taken to the main bearings of the crankshaft. Attached to one side of each crank web is a metal disc which collects the excess from the journals and conveys it centrifugally to the ducts in the hollow crank pins leading to the big ends, after which it is splashed on to the other parts of the motion. An accessible oil filter is fitted, whilst the oil pump itself is readily detachable.

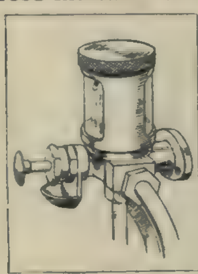


Fig. 3.—The Adler drip-feed hand valve.

Albion.

A box containing a mechanical pump and a supply of oil, the level of which can be ascertained through a gauge glass, is carried on the dashboard. The mechanical pump is of the direct acting plunger type, and is firmly mounted on a horizontal ratchet wheel in such a manner that its plunger is operated by a series of cams on the lid of the box when the ratchet is rotated by an oscillating pawl driven from the camshaft. The one pump is made to feed in turn six separate pipes leading respectively to the main bearings, the thrust side of the cylinders, and to the connecting rods. The latter are served by oil retaining rings fixed to the crankshaft webs, the oil pumped on to them being forced centrifugally through holes in the webs and crank pins to the bushes. The spindle of the ratchet pin passes through the lid of the box and terminates in a handle which is used to indicate which bearing is being served by the pump. It also allows the pump to be operated by hand when an additional supply is required. Each pump delivery is regulated by a screw-down valve.

Alldays.

A gear pump driven off the camshaft draws oil from the sump and delivers it *via* a pressure relief valve to an external distributing base, which directs it to the three main crankshaft bearings, from which it is taken by internal diagonal leads to the big end bearings. From here it is splashed on to other parts of the engine. When the pressure rises above a predetermined amount the relief valve by-passes the surplus oil directly back into the sump, which is filled through a tube attached at its forward end. Copper pipes are used throughout for conveying the oil to the points of application.

Arrol-Johnston.

Oil is filled into a sump forming the base of the crank chamber and passes through a large detachable cylindrical filter to a rotary pinion pump driven off the camshaft, whence it is forced direct to the three main crankshaft bearings and thence through the diagonally drilled webs to the big ends, from which excess is flung to the cylinder walls, camshaft, etc. An adjustable screw-down valve is arranged on the end of the crank case by which the flow can be set to the desired amount. The level of the oil in the sump is ascertained by a dipper rod.

Clement.

The crank chamber is filled through a conical cup provided with a filter to a level determined by an overflow tap. From the sump oil is drawn by a rotary pump of the pinion type and delivered direct to the main bearings, and to the connecting rod bearings through the drilled crank webs. A sight feed indicator on the dashboard is introduced into a branch pipe from the main delivery, and the flow from this sight feed is taken to the timing wheels. In the event of the sight feed indicator becoming clogged a small pet cock on the main oil pipe indicates whether the circulation is in action or not.

Crossley.

Oil contained in the sump is drawn through a filter by a gear pump attached to the extension of the camshaft, which forces it along a pipe having branches which direct it to the three main bearings, whence it passes through the drilled crank pins and crank webs to the big end bearings. The piston, cylinder walls, and gudgeon pin bearings are lubricated by the excess of oil which is splashed on to them, as also is the camshaft. The timing gear at the front of the engine is lubricated direct from the pump through a separate pipe. A pressure gauge is fitted on the dashboard, and is connected with a by-pass valve which allows the feed to be adjusted. An inclined glass oil gauge is attached to the side of the sump from which the filter is readily removable.

De Dion Bouton.

The supply of oil is carried in the sump, above which is a sheet of metal gauze extending over its whole surface. The pump is of the pinion type driven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direct from the front end of the camshaft and forces the oil direct to the camshaft bearings, and also the main bearings of the crankshaft, whence it passes to the big end bearings through the drilled crankshaft. A by-pass or return valve is provided to prevent excessive lubrication at high engine speeds and a combined oil level gauge and drain cock is mounted on the side of the sump.

Delahaye.

A gear pump level with the base of the sump draws oil therefrom and passes it to the two main bearings of the crankshaft, which is drilled to allow the oil to pass through to the big ends and afterwards to the other working parts by splash. The working of the system is indicated by a manometer on the dashboard, and the supply is controlled by an adjustable needle valve supported at the side of the crank chamber. Contained inside this valve is a gauge rod, by removing which the amount of oil in the sump can be readily ascertained, and also a special filler cap through which the sump is replenished. The emptying device by which the required level of oil can be obtained is very ingenious. When the emptying-valve handle is turned to its open position only a small quantity of oil is run out, and no more will flow even should the handle be left in that position. To empty a further amount the valve is turned to its shut position, when the small reservoir it contains is filled, and upon turning the handle another small amount is discharged.

Enfield.

The engine is provided with a system exactly similar to that of the Alldays, except that the pump is placed on a level with the sump, where it is driven by spiral gearing from the camshaft. The sump is also provided with a gauge indicating the amount of oil therein.

Fafnir.

A pinion pump carried on the rear end of the camshaft draws oil from a sump which serves as a tank and delivers it through a tell-tale on the dashboard to the three main crankshaft bearings, whence it is conveyed centrifugally to the big end bearings through diagonally drilled crank webs, after which it is splashed on to the cylinder walls, piston, and gudgeon pins. The oil level in the sump can be ascertained by a three-way valve, operated by a lever working upon a quadrant, which allows the oil to be drawn off when necessary, and also provides an overflow above the maximum desirable level.

Hotchkiss.

This system comprises a sump arranged in the usual way, and is distinguished by the design of the pump. This is of the direct plunger type with an oscillating cylinder, the piston being operated by an eccentric mounted on the end of the crankshaft. The combined connecting rod and piston is hollow, and the boss of the eccentric is arranged with a segmental port, which performs the function of a cut off valve at the correct point of the stroke. At the top of this stroke the plunger opens ports in the cylinder, through which oil flows and displaces the partial vacuum created. On its down stroke oil is forced up the plunger, through the port in the eccentric boss, and thence to the drilled crankshaft, by which means oil proceeds to the mainshaft bearings, and also to the big ends, from which the excess is sprayed on to the cylinder walls, camshaft, and gudgeon pins. Surrounding the oscillating cylinder of the pump is an inverted bell containing a filter, and the mouth of which is brought close down to the base of the sump to ensure that the last drop of oil therein is passed into circulation. The above drawing illustrates the design of the pump, and also shows the small relief valve which is used to prevent the pressure rising too high. A pressure gauge is fitted to the dashboard. The level in the sump is verified by two overflow cocks.

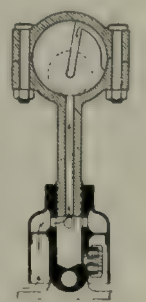


Fig. 4.—Section of the Hotchkiss oil pump.

Humber.

In the Humber system oil contained in the sump is forced by a vertical pinion pump in the base to a horizontal duct cast in the crank chamber with branches to the four main crankshaft bearings, the oil being taken to the big ends by the diagonally drilled webs. Oil is also forced from this main duct through a visible drip feed indicator on the dashboard, from which it runs back into the sump. An adjustable spring loaded relief valve short-circuits the oil from the main duct back to the sump when the pressure rises too high.

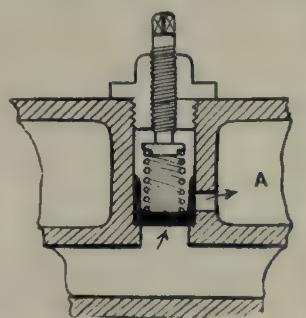


Fig. 5.—The arrangement of the oil relief valve in the Humber system. The letter A indicates a duct leading back to the sump and the arrow shows the direction of the oil-flow when the relief valve is lifted.

Mercedes.

(15, 20, and 25 h.p. models.) The oil supply is contained in the crank chamber sump, from which it is drawn by a special type of plunger pump to a three-way valve, which directs it to the main bearings of the crank chamber and thence to the connecting rod big ends, the rest of the moving parts being served by splash. Another branch from the distributer supplies the sight feed on the dashboard. The three-way distributer is furnished with a valve inter-connected to the accelerator pedal in such a way that as the throttle is opened the supply of lubrication to all the bearings is directly increased. The oil which has been circulated is not allowed to mix with the clean fresh oil contained in the sump, but is freshened by an admixture of unused lubricant which is forced to it on every stroke of the pump. This is of the plunger type, and is driven by skew and bevel gear from the centre of the camshaft. The pistons are operated by three eccentrics, one of which actuates the main plunger, the second a small plunger for introducing fresh oil into circulation, and the third a piston valve controlling the suction and delivery of the main plunger.

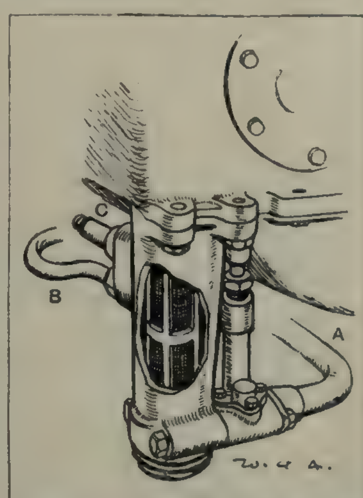


Fig. 6.—The Napier pump arrangement showing the position of the filter. A is the suction pipe, B the delivery and and C the relief valve.

Lubricating Systems.

On the higher powered Mercédès models a Friedemann multiple oil pump contained in a box (which serves also as a supply tank) is operated from one end of the camshaft, and delivers oil to the three main crankshaft bearings and to each cylinder as well as to other parts of the chassis. A supplementary hand pump is fitted.

Napier.

Oil is supplied to the sump through a filler on the crank case arm until it commences to flow through a level tap. It is forced at a pressure of 15 lbs. through the main bearings and through the crankshaft to the big end bearings by a rotary pump driven by skew gear from the camshaft, and situated at the flywheel end of the engine. The pump is carried by a hollow column connected with the sump and containing a quickly detachable filter, through which the oil continually passes in its circulation. An adjustable relief valve is fitted and also a pressure gauge on the dashboard. Fig. 6 shows the arrangement of the Napier pump on the 45 h.p. and 65 h.p. models.

S.C A.T.

A pump level with the base of the sump forces oil to the three main crankshaft bearings, and through the hollow shaft to the big ends, whence it is thrown on to the cylinder walls, gudgeon pins, and camshaft. The pump itself is driven from a vertical spindle actuated by the camshaft, and is placed in an accessible position outside the sump.

Star.

The system used on the Star engines embraces a pinion pump driven by the camshaft, and circulating oil from the sump through the three main bearings, and then through the hollow crankshaft webs to the big end bearings. The main oil passage is cast into the crank chamber, and carries an adjustable mushroom-headed relief valve, which discharges the excess of oil into the crank chamber. In order to prevent, as far as possible, the pump from running dry and so failing, ball foot valves are fitted both above and below, and, in addition, a priming tube is fitted inside the bonnet, through which the pump may be filled after the car has been left standing for some considerable time. An ordinary pressure gauge is mounted on the dashboard.

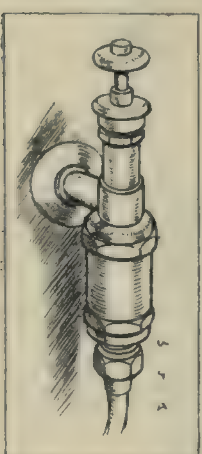


Fig. 7.—The plunger oil indicator on Sunbeam cars.

Sunbeam.

In the Sunbeam a tubular copper duct is used, and the rotary pinion pump is placed slightly lower than the base of the sump and actuated by a long, vertical, skew gear-driven shaft. The five crankshaft bearings are fed from a large diameter copper tube, and thence oil passes through drilled webs in the big ends, after which it is splashed. A piston type of circulation indicator is carried on the dashboard, and above it is an oil pressure regulator in the form of a by-pass, which open, gives "half oil" and closed, "full oil."

Talbot.

(20 h.p. six-cylinder model.) A sump cast in one with the crank chamber acts as an oil container, and is provided with a rotary pinion pump driven from the camshaft. This forces oil, after drawing it through a filter, direct to the main bearings, whence it proceeds to the big ends through the hollow crankshaft. The excess, which is forced out through the clearance of the bearings, is splashed on to the cylinder walls, gudgeon pins, camshaft, etc. The main delivery pipe is branched to a pressure gauge on the dashboard reading up to 25 lbs. The normal pressure is about 12 lbs.

Vauxhall.

This system employs the usual sump and feed to the main bearings and to the big ends through the drilled shaft. Piping is used throughout in place of ducts. The pump is of the direct-acting plunger type driven by a ball bearing eccentric carried on the end of the camshaft. The pressure of the circulation is registered by a gauge on the dashboard, and this also carries a small tell-tale which makes a movement with every stroke of the pump. The latter is readily detached complete. A float inside the sump indicates the level of the oil therein. A neat feature of the Vauxhall is the valve by which dirt or other residue is removed from the sump without letting out more than a minimum of oil. A section of this valve is shown in the accompanying sketch, which clearly indicates its working. Normally, the inverted cap holds the mushroom valve off its seat. Upon unscrewing the cap it brings away with it the oil residue which has collected beneath the valve. The latter then seats itself and prevents any oil from passing until the cap is replaced. The latest pattern Vauxhall engines have a large strainer tray between the crank chamber and sump. This tray can be drawn out at the front by removing eight bolts which hold it in position.

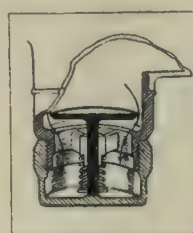


Fig. 8.—Section of the Vauxhall sludge valve

Vinot.

This system differs in several respects from any of the foregoing. A vertical gear pump driven from the crankshaft, and carried at the end of the sump nearest the flywheel, delivers oil to the centre main bearing of the crankshaft, which is hollow throughout, and by this means oil reaches the two other main bearings and big ends, from which it is splashed on to the cylinder walls, etc. It is returned to the sump through ducts drilled in the main end bearings, the front one of which also communicates with a duct giving a positive feed to the camshaft. A relief valve returns any excess of oil to the sump, and the oil is passed through two filters on each circuit.

Section III. Mechanical to Main Bearings, Splash to Other Parts.

Adams.

Oil contained in the crank chamber sump is forced by a pinion pump operated by a vertical shaft skew-gear driven from the camshaft through a piston-type tell-tale on the dashboard, and thence direct to the main bearings and timing gears. It also delivers to shallow troughs cast in the top of the sump and coming immediately under the big ends of the connecting rods. The big ends are provided with scoops which splash oil on to the rest of the moving parts. A filter is placed between the sump and the suction port of the pump. The level of oil in the sump is indicated by a three-way cock of easy access.

Argyll.

(Sleeve valve model.) A rotary pinion pump, driven by skew gearing from the valve operating shaft, draws oil from the sump, the level in which is indicated by a float, and discharges to the three main

bearings of the crankshaft through steel lined cast-in ducts. Oil is also delivered to four deep troughs immediately under the big end bearings which are fitted with scoops or dippers and serve to splash the oil over all moving parts of the engine. The pump also directs a stream of oil on to the skew-geared valve mechanism. A notable point is that in order to cool as far as possible the oil that is in the sump the base of the latter is formed with external longitudinal radiating flanges.

Austin.

Two rotary pinion pumps driven by skew gearing from the camshaft draw oil from each end of the sump, thus preventing the possibility of the supply being interfered with when the car is standing on a stiff gradient. Oil is passed to the five main crankshaft bearings, from which it is thrown by centrifugal force on to the deflectors fitted to each side of the crank webs. The function of the deflectors is to throw the oil into the hollow crank pins and so to the big end bearings. Excess is splashed on to the cylinder walls, gudgeon pin, and camshaft. The two oil pumps are both driven by the same shaft, and either is sufficient to maintain an efficient circulation. Underneath the crankshaft are fitted two sloping trays joined by a gauze strainer which forms the top of the sump. The arrangement of these trays is such that even when running on an extremely steep gradient there is no likelihood of the oil in the sump coming into contact with either front or rear big ends, and so forming a smoky exhaust. A graduated gauge shows the amount of oil supply, whilst a pressure gauge forms an indicator on the dashboard. A by-pass relief valve is fitted to the main oil delivery pipe.

Austro-Daimler.

Attached to the timing gear housing are a pair of direct acting plunger pumps driven by eccentrics, which are in turn operated from the camshaft through a worm gear. The case containing these pumps serves also as an oil vessel. There is no actual circulation of oil, as it is conveyed direct to the bearings and not returned, and means of adjustment are therefore provided by which the delivery from the pump can be increased or reduced as circumstances may dictate. One of the pumps delivers to the three main bearings of the crankshaft, from which the oil drips into the base chamber, which has no sump, and is, therefore, splashed by the connecting rod big-ends which lubricate themselves and the rest of the motion in this manner. The second pump discharges directly to the thrust wall of each cylinder.

Bell.

The oil is contained in the crank chamber sump, whence it is drawn to a gear pump driven off the camshaft, this pump being furnished with a special priming piece. The oil is then forced up to the dashboard through a piston type of indicator and down through a pipe which conveys it to pockets. From these pockets the three main crankshaft bearings are fed direct. Branches from this pipe also deliver to four troughs immediately under the big ends, the latter being fitted with scoops. The troughs are so fixed that the level of oil therein can be altered by a quadrant lever on the dashboard which opens and closes a sort of sluice gate, so that the amount of oil sprayed to the cylinder walls, etc., can be adjusted with considerable nicety.

Belsize.

Oil is drawn from the sump by a rotary pinion pump, before reaching which it passes through an easily detachable filter, and is forced up to a large glass contained on the dashboard. From here it passes down pipes directly to the main crankshaft bearings, which it reaches through cast-in ducts. The dashboard container allows any excess of oil to be returned to the sump. Underneath the big ends, which are fitted with scoops, are troughs which are kept supplied from the dashboard container at a constant level, any overflow from them falling straight back into the sump. The oil delivery is adjustable, and a pet cock is fitted to the pump so that a test of its working can readily be made.

Benz.

Oil is poured into the crank chamber sump through a cone-shaped filter. Situated at the side of the crank case, and driven by a worm gear from the camshaft is a specially designed plunger pump which directs oil through a sight feed to the main bearings, and also to troughs cast in the top of the sump immediately under the connecting rod big ends. The pump draws and discharges through filters which are easily get-at-able. The arrangement of the positive pump is shown in the sketch fig. 9. It is furnished with a combined reciprocating and rotating action, and is entirely valveless. A small portion of the pump body is square in section, and carries loosely on it the worm pinion by which it is driven. The upper end of the pump body is furnished with a helical groove in which runs a small fixed set-pin, so that, upon being rotated, the plunger of the pump reciprocates to and fro. At the base of the plunger is provided an L-shaped port which communicates in turn with the intake and delivery orifices which are placed at either side. The sight feed is of individual type, and consists of a white enamelled surface over which the oil flows like a miniature waterfall. This indicator is carried on the dashboard.

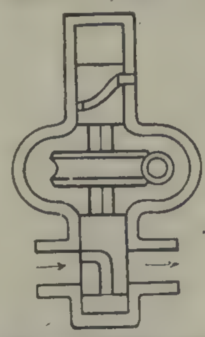


Fig. 9.—A diagram of the Benz combined rotary and reciprocating pump.

Brasier.

The supply of oil is contained in a box supported on the side of the crank chamber. Inside this box are three direct-acting plunger pumps, each separately adjustable, and driven by a worm gear from a cross-shaft actuated by the camshaft. One of these pumps forces oil to the timing gear and also to the gear box. The other two deliver to cups which supply the main bearings of the crankshaft, whence the overflow of oil drops to the base of the crank chamber, which has no sump, and is accordingly splashed over all the working parts. For this purpose one pump only is quite sufficient, and the delivery of the second pump is therefore throttled down by a lever on the dashboard which short-circuits the supply back to the oil container. When additional oil delivery is required, such as when climbing a long hill, this lever is thrown over and the second pump then delivers to the main bearings. Enough oil is contained within the crank chamber to last a considerable time in the event of anything going amiss with the pumps.

Brenna.

On the rear pair of cylinders is bolted a box serving as an oil vessel, and containing also two direct-acting plunger pumps driven by a skew gear and eccentric sleeves from the camshaft. Each pump is double acting and supplies two outlets. Of these three lead

Lubricating Systems.

to the main engine bearings and the fourth to the thrust collar on the clutch fork. The crank chamber is divided by a transverse wall into two parts, each of which serves two big end bearings by splash. The oil is also sprayed on to the cylinder walls, gudgeon pins, camshaft, etc. The timing wheels are lubricated direct from the forward crank chamber compartment, oil being splashed through an aperture in the dividing wall. The delivery from the positive pumps is adjusted by altering their stroke, which can be done with very great accuracy by means of a screw gear provided for the purpose.

Delage.

The oil supply is contained in a tank underneath the bonnet, the tank having an extension passing through the dashboard and containing a gauge glass through which the level of the oil can be seen. From the tank oil flows by gravity to the two main bearings of the crankshaft, the rest of the engine being lubricated by splash. The crank chamber is provided with a sump containing two filters, from which oil is drawn by a gear pump carried on an extension of the camshaft and returned thereby to the tank. In order to prevent oil being supplied too rapidly at high engine speeds, the tank is provided with an overflow pipe, the orifice of which is closed against the lid of the tank. This overflow pipe is taken to the base of the crank chamber. A useful point in connection with this overflow pipe is that should the driver upon starting the engine fail to turn on a tap which is fitted to the dashboard, the oil level in the tank would at once rise to a noticeable extent.

La Buire.

A pinion pump, driven through an inclined shaft skew geared from the camshaft, is placed at the bottom of the sump, from which it draws oil and forces it through a rotary indicator on the dashboard to a cast-in distributing duct which leads it to the main bearings. Pipes from the same pump also feed troughs placed in the big end bearings, the latter being furnished with large scoops, serving not only to direct the oil to the bushes but to spray it all over the working parts. At the side of the sump is a double valve which in different positions of a lever serves both for the emptying and filling in of oil.

Panhard.

(25 h.p. model.) A pump connected to the sleeve valve operating shaft draws oil from the sump and delivers it to the main bearings of the crankshaft through a small sight-feed indicator on the dashboard. The other working parts are lubricated by splash. A special feature of the system is that the drip feed chamber is connected by a small pipe to the mixing chamber of the carburetter. The action is, therefore, as follows: When the throttle is opened and the load on the engine increased, the vacuum in the carburetter is enhanced, and as this applies also to the drip feed, the consequent reduction of pressure causes an additional supply of oil to flow. By this means an oil feed more or less proportional to the load of the engine is obtained.

Peugeot.

The oil supply is carried in a tank fixed to the dashboard under the bonnet. This box contains a pump driven through an external coupling by an eccentric on the rear end of the camshaft. The pump forces oil to a combined distributer and sight feed gauge on the dashboard containing four separately adjustable drips. The main supply from the pump is also controllable. The drips supply the main bearings, after which lubrication is by splash. The crank webs are furnished with deflector plates, which deliver oil by centrifugal force to the big end bearings. The base of the crank chamber is furnished with overflow pipes taken from a suitable level, and also draw-off cocks from each half of the crank chamber, which is divided by a transverse wall. These cocks are worked by an ingeniously arranged valve of the sliding piston type.

Rover.

A sump beneath the crank chamber serves as an oil tank, and from this oil is drawn by a rotary pinion pump placed at the lowest point of the sump and operated by a vertical shaft actuated by a skew gearing from the camshaft. The pump supplies the four troughs placed underneath the big ends, which are furnished with scoops for oiling themselves and for splashing on to the other parts of the engine, and also the chain-driven distribution gearing. A division between the crank chamber and the sump is formed by a gauze diaphragm, through which excess of oil drips back into the sump.

Sheffield-Simplex.

Oil contained in the sump—which is filled through a self-locking cap interconnected with an overflow tap for registering the level—is circulated to the seven main crankshaft bearings, which it reaches *via* hollow webs, by a pinion pump which is driven by an extension of the inclined worm shaft that forms an intermediate between the crankshaft and camshaft pinions of the timing gear. A cast-in duct running the length of the crank chamber is supplied at two points from the pump and directs the flow to the journals through cast branch ducts. Oil thrown out of the bearings is caught in troughs immediately beneath them and flows to a second series of troughs under the big ends which are furnished with scoops and splash the oil to the rest of the motion. At high engine speeds extra oil is forced to the cylinder walls. This is arranged by the movement of the throttle lever opening a valve so that extra oil is passed at a pre-determined position of the throttle. The camshaft is contained in an entirely separate housing where it is lubricated independently by thick oil. A lateral extension of the sump carries a large double conical filter which is instantly detached by undoing a bayonet joint.

Sizaire-Naudin.

(15 h.p. model) A skew gear driven pinion pump takes oil from the crank chamber sump, wherein it is contained, and delivers it direct to the two main crankshaft bearings, whence it passes through the drilled webs of the big end bushes, the camshaft pistons and gudgeon pins being oiled by splash. A pressure gauge fixed on the dashboard is included in the circuit.

Standard.

Oil is contained in the sump below the crank chamber as well as in a supplementary tank inside the bonnet. At the base of the sump is an eccentric paddle type of pump in which vanes are held against the walls of their eccentric chamber by springs. The pump is provided with a relief valve allowing excess of oil to be returned to the base chamber. On the dashboard is an oil circulating indicator of the piston type which can be both seen and felt. From here the oil passes to a combined filter and distributer which leads it to each of the main shaft bearings and also to the timing gear. Attached to the crankshaft and overlapping the flanges of the main bearings are annular gutters which collect the overflow and convey

it through holes in the webs to the connecting rod bearings, leaving which it is sprayed on the cylinder walls and returned to the base chamber. An ingenious arrangement is adopted to allow the driver to ascertain whether there is a sufficiency of oil in the base chamber without getting out of his seat. On the steering column is a small rubber bulb connected by a pipe to a point representing the minimum level of the sump. This pipe also contains a small whistle. Pressing the bulb blows the whistle if the bottom orifice of the pipe be covered by oil, but if not the whistle is not blown. Should the engine be started up with the oil below the level of the pipe the alternating pressure in the base chamber at low engine speed blows the whistle and so gives the driver due warning.

Straker-Squire.

Oil contained in the crank chamber sump (into which it is poured through a large conical filler provided with a filter) is circulated through a gear pump driven through a vertical shaft by skew gearing from the camshaft. From this point the oil is taken direct to a plunger type of tell-tale on the dashboard, passing thence to a distributing tube inside the crank chamber which directs the oil to the underside of the five main crankshaft bearings. Oil is also supplied to four troughs cast in the plate which forms the lid of the sump, and into which scoops on the big ends dip, lubricating their own bearings and throwing oil also on to the cylinder walls, gudgeon pins, big ends, etc. A glazed inspection door on the side of the sump allows the oil level to be readily perceived.

Swift.

A crank chamber sump serves as an oil tank from which oil is forced under pressure to the main bearings by means of a small vane pump contained in a housing on the side of the crank chamber where it is operated by a worm-driven vertical spindle from the camshaft. After leaving the pump the oil is passed to the main bearings, and also to troughs underneath each big end, the rest of the moving parts being served by splash. An oil level cock is fitted on the side of the sump.

Wolseley.

A rotary pinion pump driven by a skew gear from the camshaft draws oil from the crank chamber sump, which is filled through one of the bearer arms, and forces it to the main bearings and to the troughs which are placed directly beneath the big ends, the latter being furnished with scoops for the collection and splashing of the oil to the cylinders, camshaft, etc. A branch pipe from the pump leads to a tell-tale on the dashboard.

White and Poppe.

(Dennis and Singer.) At the lowest point of the sump underneath the crank chamber are two rotary pumps, one of which serves to draw oil from a reservoir, which can be placed in any convenient position on the chassis, and forces it to the working parts, whilst the other returns it, after its circulation through a filter, back to the reservoir. These pumps are driven by a vertical spindle actuated by the camshaft. The oil is led by external pipes to the main bearings, which are kept flooded. Excess of oil passes to troughs underneath the big ends which carry scoops for taking it up and spraying it to the gudgeon pins and cylinder walls. Gutters are formed on the partitions carrying the main bearings, so that oil splashed up is caught by them and passed again through these journals.

Section IV. Splash.

Ariel.

The crank chamber is not provided with a sump, but oil is carried in a separate container fixed to any convenient part of the chassis. Two oil pumps are used, and have for their functions, in the first case to draw oil from the tank and deliver it to troughs under the big end bearings, while the other returns excess of oil (which overflows from these and drips down into the crank case after being splashed to the other working parts) through a filter back into the tank. As the pump delivery from the engine is of larger capacity than that to the engine, any surplus oil which falls into the crank chamber after the engine has been standing for some time is quickly removed before it has a chance to be splashed up. A pressure gauge is fitted to the dashboard.

Cadillac.

The floor of the crank chamber is formed with troughs into which dip short curved pipes attached to the big end bearings. The crank chamber is divided into four separate compartments furnished with sloping gutters on the sides, and these gutters distribute the oil from one compartment to the other, so that the possibility of oil collecting at one end of the crank chamber is prevented. The oil reservoir is carried on the side of the crank chamber, and contains a double acting pump driven by the magneto driving-shaft. Oil is fed to the main bearings, gudgeon pins, and cylinder bearings by splash.

Charron.

Great simplicity and a variable feed are characteristics of this system. Oil is contained in a tank placed behind the water tank of the radiator on the front of the dashboard, and feeds to the base chamber through a sight feed indicator which allows the flow to be adjusted by means of a ratchet thumbscrew. A second control of the oil supply is obtained by inter-connecting the movement of the accelerator pedal with a valve attached to the sight feed. When the throttle is opened an additional supply of oil is therefore given to the engine. The oil is circulated entirely by gravity and splash.

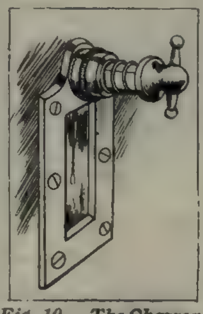


Fig. 10.—The Charron drip-feed and regulating valve.

Daimler.

Immediately over the sump, which contains a large supply of oil, are a series of troughs, and into these dip the scooped big ends, which splash oil to the sleeve valves, valve actuating shaft, gudgeon pins, cylinder walls, and main shaft, the bearings of the latter being provided with cups to ensure a full supply of lubrication. The troughs are supported on shackles, by means of which they are raised and lowered, and as this movement is performed by

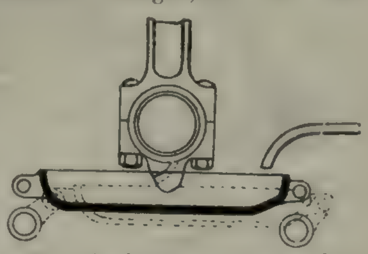


Fig. 11.—The arrangement of the Daimler adjustable troughs.

Lubricating Systems.

the throttle lever a supply of oil is given proportional to the opening of the throttle. The troughs are supplied by a direct acting plunger pump of the multiple type, the five pistons of which are simultaneously operated by a connecting rod working from an eccentric of the valve actuating shaft. A second connecting rod works a rocking valve common to all the pumps, and regulates their suction and delivery. Four of the pumps deliver direct to the troughs, which they keep completely filled with oil. The excess and that which is splashed returns to the sump through a filter. The fifth pump delivers to the sight-feed gauge on the dashboard, which indicates the correct working of the system. The arrangement is, of course, quite independent of the gradient upon which the car stands. An exactly similar system is used on the Knight engines of the Siddeley-Deasy, B.S.A., and Minerva cars.

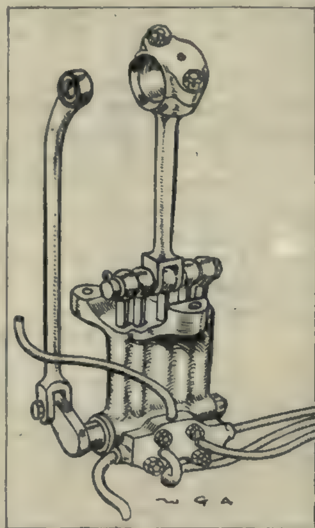


Fig. 12.—The Daimler multiple plunger pump. The short lever with a long connecting rod on the left regulates the suction and delivery.

Darracq.

The crank chamber is of the plain type without any sump, and the supply of oil is carried in a tank attached to the dashboard underneath the bonnet. From this it flows to a rotary pinion pump driven through a spring connection by the rear end of the camshaft. This pump forces the oil back to the dashboard, where it passes through an adjustable sight feed and thence to the crank chamber, where it is caught by scoops on the big ends and splashed to the cylinder walls, gudgeon pins, etc. Large ducts are provided for the main bearings to ensure their thorough lubrication. Should, by some mischance, the pump stop working, the supply of oil in the crank chamber is sufficient to run the car for a considerable distance.

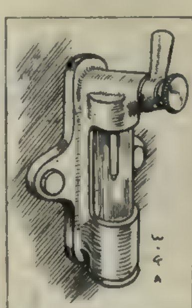


Fig. 13.—The Darracq adjustable sight-feed on the dashboard.

E.M.F.

The keynote of the E.M.F. system is simplicity, and it works upon an ingenious adaptation of the vacuum or "chicken-trough" principle. The supply of lubricant is carried in a box cast on the side of the crank chamber. This box allows the oil to flow to the two portions of the crank chamber, which is divided by a transverse wall, through two pipes. When the ends of these two pipes are submerged in the oil no air can pass, and a further supply is discontinued until the consumption of the engine reduces the oil level, upon which it is automatically restored. Lubricant is conveyed to all bearings by direct splash. An ingenious valve is arranged to prevent oil flowing into the crank chamber when the supply is being replenished. Unscrewing of the filler cap releases a spindle and allows a spring propelled valve to cut off communication between the tank and the crank chamber. The supply tank is furnished with a glass oil gauge.

Ford.

This system is also notable for its extreme simplicity, as no additional working parts whatever are required. Oil is filled into the housing which covers the flywheel and low-tension magneto. On the upper side of this housing is a cup which collects oil thrown into it by centrifugal force, and delivers it by gravity to the main bearings, whence it falls into the crank chamber, in which are cast transverse troughs immediately under the big ends. Oil so collected is splashed on to all reciprocating parts. The same system is used to lubricate the epicyclic gear, timing gear, and back axle. The magnitude of the oil flow depends upon the speed of the engine.

Le Gui.

The oil supply is carried in a tank supported on the dashboard, which also contains a direct acting plunger pump. This is operated by a push rod worked by an eccentric on the camshaft, the actual working of the pump plunger being carried out by a rocking cam and the plunger being returned by a spring. On leaving the pump the oil passes to a visible drip feed and thence to the base chamber, where all working parts are lubricated by splash. The supply of oil is controlled by shortening or lengthening the stroke of the pump, this adjustment being carried out by a screwed knob carrying a stem, which presses against a disc on the top of the pump plunger and acts as a stop. Without in any way interfering with the setting of the pump feed, the knob and its stem can be used independently of a screw regulating device to operate the plunger when it is desired to give an extra supply of oil. The tank and pump are accessible upon lifting the bonnet, but normally only the sight feed drip is visible. A similar system, but containing a pressure relief valve, is used on Palladium cars.

Hudson.

A constant level of oil is maintained in the crank chamber by means of a positive pump driven by a special cam on the camshaft. The base chamber is divided by transverse walls which ensure an even supply of oil being splashed on to all working parts by the connecting rods. Any excess delivered by the pump is drained through a filter to the sump below the base chamber in which the supply of lubricating oil is carried.

Martini.

A rotary oil pump, level with the base of the sump, draws oil therefrom and discharges it through an indicator on the dashboard. Thence it passes by gravity to four deep troughs which are placed underneath the connecting rods, and from which the oil is splashed on to the main bearings and all the other working parts. The dashboard indicator consists of a glass tube through which the oil is pumped, and which contains a metal ball which is supported within sight of the driver by the oil pressure. Should this drop to any impracticable amount the ball disappears from view. At the side of the oil sump is an inclined three way valve which indicates the maximum and minimum levels of oil supply.

R.M.C.

Oil is contained in the sump underneath the crank chamber, and is delivered at a constant level to the latter by a rotary pinion pump. The level is maintained by two overflow pipes projecting about ¾in.

above the level of the crank chamber floor. The latter is formed under each big end with troughs which are plugged by studs passing through the base of the sump. Removal of these allows any dirt which is collected in the oil, and which naturally flows to the base of these depressions, to be readily removed. Jets of oil are delivered from the pump direct on to the big ends, which splash oil on to the remaining parts. A fourth ring is fitted to the bottom of the piston, and largely prevents over lubrication having any ill effect. The gudgeon pins, which are fixed to the connecting rod and move in bearings in the piston, get well lubricated from the cylinder walls. The main journals are provided with large oil pockets.

Vulcan.

Oil contained in the sump which carries the supply is directed by a rotary gear pump through a tell-tale of the piston type on the dashboard, whence it descends to a manifold which serves troughs in each big end and also the timing gear. The connecting rods are furnished with large scoops. The supply of oil to the main bearings, cylinder walls, and gudgeon pins is by direct splash. The oil ultimately drains back into the sump, and is filtered before being used again.

Warren.

The lower half of the crank chamber is cast in the form of a sump, which acts as an oil reservoir. From this a piston pump worked by an eccentric on the camshaft lifts oil and passes it through a sight feed on the dashboard, and thence into the crank chamber, which is divided into two compartments by a wall. The big ends dip into the oil and splash it on to all parts of the engine. Constant level is maintained in all the compartments, which overflow back into the sump. The whole of the oiling system, together with the pump, is readily detachable, as it is all attached to the bottom half of the crank chamber.

Motoring in England and on the Continent.

Taxation and Customs Systems Explained.

IN order to assist Colonial motorists who come home and buy a car with the intention of doing a few months' touring in England and on the Continent before taking their departure, the following information relating to taxation systems and customs formalities here and on the Continent has been prepared. A very small proportion of our overseas visitors bring their cars with them, but they would only amount to about one per cent. of the total number. In such cases the visiting motorist is exempt from the local taxation licences if he does not stop in the country longer than four months. If he runs the car more than four months from the date of registration he has to take out a local taxation licence (see below). Then there are others who favour the policy of buying a second-hand car and selling it, perhaps at a sacrifice, before returning.

It will be assumed that the Colonial motorist has arrived in England, and is about to take delivery of a car. If he is wise he will have ordered it two or three months before leaving his home, as the principal manufacturers are never in a position to give immediate delivery at the time of the annual influx of visitors from the Colonies and Overseas Dominions. Of course, if one is easily satisfied and has no special requirements and ideas to be embodied in one's car, it is quite possible to buy one straight away from many of the London showrooms.

It is a very good plan to join either the Royal Automobile Club, either as a full member, or as an associate, which costs but one guinea, or the Automobile Association and Motor Union, especially if a Continental tour figures on the programme, as both these organisations are in a position to make all arrangements and offer suggestions for touring abroad. Particulars of both the Royal A.C. and the A.A. and M.U. will be found on pages 106 and 107.

Having got delivery of the car, the first thing to do is to obtain a driving licence (5s.), which may be obtained from any police office. There is no test to undergo before the licence is granted. It must always be carried when driving, and produced to any constable upon demand. Police court cases of driving without a licence are not uncommon, so care should be taken to see that no run, however short, is commenced without this document being in one's pocket.

The motor car must be registered (£1 at any police office), and when this is done a number will be allocated. Number plates with the identification numbers and letters printed on must then be affixed at both the front and back of the car. A local taxation licence must also be obtained (from a post office), for which the charges are as follows:

	£	s.	d.
Cars not exceeding 6½ h.p.	£2	2	0
Exceeding 6½ but not exceeding 12 h.p. ...	3	3	0
,, 12 ,, ,, ,, 16 h.p. ...	4	4	0
,, 16 ,, ,, ,, 26 h.p. ...	6	6	0
,, 26 ,, ,, ,, 33 h.p. ...	8	8	0
,, 33 ,, ,, ,, 40 h.p. ...	10	10	0
,, 40 ,, ,, ,, 60 h.p. ...	21	0	0
,, 60 h.p.	42	0	0

The above classification is for touring cars only.

The horse-power is arrived at by R.A.C. rating, *i.e.*, $\frac{D^2 \times N}{2.5}$ where D = bore, N = No. of cylinders.

The method of arriving at the h.p. is obviously unfair, as stroke is not taken into account, but it is the law, and although it has come in for a great deal of criticism, and at one time there appeared to be prospects of it being altered, everything at the time of writing points to motorists having to make the best of a very unsatisfactory state of affairs for the immediate future at any rate.

Another very unjust point of this taxation system, and one directly affecting those motorists for whom this article is especially written, is the fact that no concession is allowed to a motorist buying an English car, using it here a period of two months in England, and then taking it back with him to Australia. He has to pay the full year's taxation whether he is motoring in England twelve days or twelve months. The only concession made is in the case of a car kept and used for the first time in any year after October 1st, when the above amounts are reduced by one-half. The Colonial motorist visiting home in the summer is not generally in a position to take advantage of this concession.

Having obtained a driving licence, registered the car, and obtained a local taxation licence, all Great Britain and Ireland is open to the motorist. Those contemplating motoring for the first time at home may be somewhat deterred from doing so by the large number of police traps and the methods adopted by the police, which they have doubtless heard so

Motoring in England and on the Continent.

much about during the past five years. This need not be so. There are not nearly so many traps worked now as there were two or three years ago, and the prejudice shown by police and magistrates towards motorists has greatly diminished. *The Autocar* publishes two or three times during the summer a map on which the location of all known traps is indicated.

The speed limit of twenty miles an hour may be habitually exceeded when road conditions allow, except in districts where the police are known to be active or where special speed limits exist. The rule of the road is to keep to the left and overtake on the right. Trams may be overtaken on the right or left according to circumstances.

Provided he has time, the Overseas visitor should most certainly take his car on to the Continent, if it is only for two or three weeks.

Indian and Australian motorists taking cars back with them often do the Continent last, and then join their boat at Marseilles, Toulon, or Naples.

Before motoring abroad the two questions which arise are those relating to International Travelling Passes and Triptyques. International Passes and Triptyques are two quite separate things, and the why and the wherefore of each is explained herewith.

International Travelling Passes allow motorists to travel in countries which are parties to the agreement without the necessity of obtaining special driving licences and carrying special number plates for each country visited. The following is a list of countries accepting International Passes together with the distinguishing letters allotted to each:

A	Austria.	I	Italy.
B	Belgium.	MC	Monaco.
BG	Bulgaria.	MN	Montenegro.
F	France.	P	Portugal.
D	Germany.	RM	Roumania.
GB	Great Britain and Ireland.	R	Russia.
GR	Greece.	SB	Servia.
NL	Holland.	E	Spain.
H	Hungary.	S	Sweden.
		CH	Switzerland.

Passes may be obtained in England only through the R.A.C. or the A.A. and M.U., and the car must undergo examination and a photograph of the driver and particulars of the car must be supplied. Cars are then provided with the identification letter or letters of the country to which it belongs. This takes the form of a plate which is affixed to the back of the car generally just above or below the registration number. A plate also has to be fixed to the dashboard (facing driver) on which is given h.p., engine number, weight in kilos, and country of origin of the car. Motorists are not legally obliged to obtain Passes before travelling abroad, but practically everyone does, as they save such a lot of trouble and inconvenience.

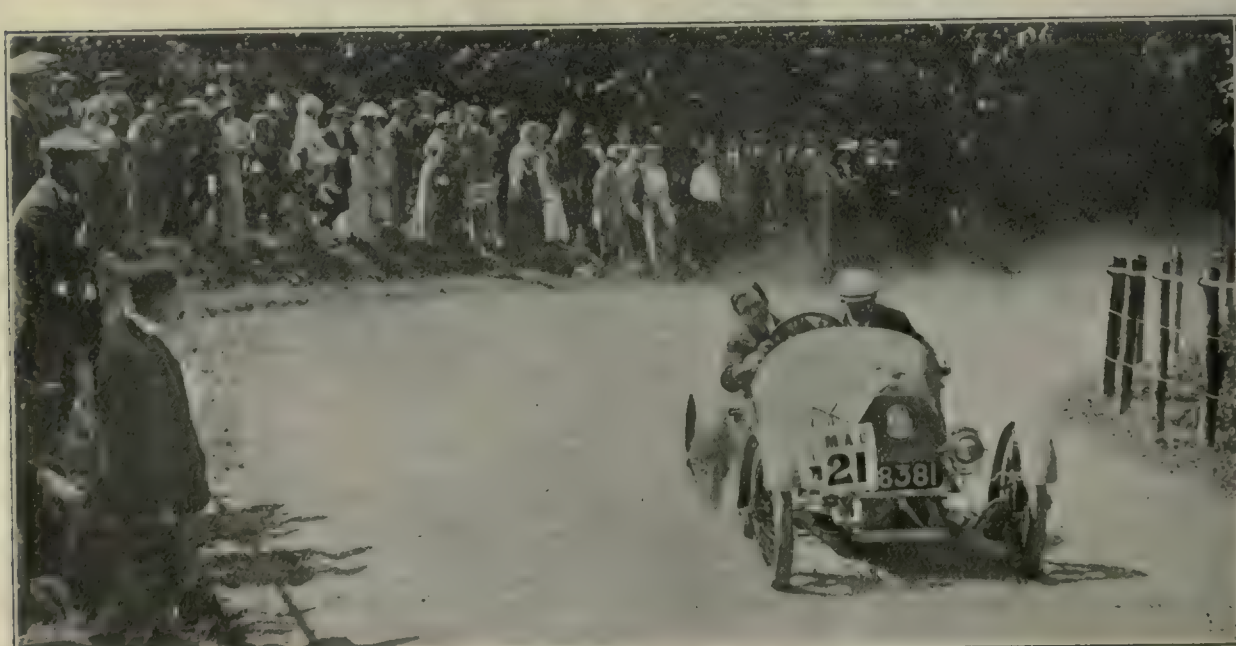
Colonial motorists entering England with Passes are charged a fee of £1 by the Customs officials at arrival ports for stamping their Passes and registering their cars.

Triptyques are as necessary as International Passes and save one carrying a large amount of money and a deal of inconvenience. The amount covering the Customs duties (ruling in the countries it is intended to traverse) is deposited with either the R.A.C. or the A.A. and M.U., who then issue a triptyque which consists of (1) portion retained by Customs officials on entry, (2) portion left with Customs on final exit, and (3) portion retained by holder and forwarded upon return to the body with which he has deposited the required amount. His full deposit is then returned to him.

Triptyques are available for the following countries: Austria, Finland, Germany, Holland, France, Italy, Switzerland, Belgium, Spain, Roumania, Russia, Norway, Sweden, and Denmark. There is in most countries a limit to the time for which they are available. Speaking generally motorists exceeding three or four months will be liable to the ordinary taxes existing in the country in which they are staying.

With the exception of Sweden, Portugal, some of the Austrian provinces, and some towns in Italy, the rule of the road on the Continent is to keep to the left and overtake on the left.

A Typical Scene at an English Hill-climb.



A competing car in the 1912 Shelsley Walsh Hill-climb, the most popular annual event of its kind.

Cycle Cars and Miniature Cars.

The Connecting Link between the Motor Car and the Motor Cycle.

THERE has lately come into bold relief a type of light car which the governing body of motor cycling, the Auto Cycle Union, has designated a cycle car, the definition being that its engine capacity must not exceed 1,100 c.c. and the total weight of the chassis shall come within the limit of 6 cwt. Though these miniature motor cars have many new points incorporated in their design, and, of course, embody up-to-date practice, the type is by no means new; in fact, many readers will no doubt have owned machines which come within the definition quoted above, for the earliest forms of motor car would now be classed as cycle cars. We refer to such cars as the Progress, De Dion, Baby Peugeot, and later the 6 h.p. Rover, Oldsmobile, Humberettes, etc. Attention has been focussed upon these miniature cars by reason of the demand which undoubtedly exists for a motor car at a price of £100 which is economical to run, reliable, and speedy. Slow speed on the level and uphill was the chief complaint of forerunners of the cycle car. Hopeful designers and makers have in many instances set out to satisfy this crying need, but when their vehicle has been completed the price has almost regularly gone up from £125 to even as much as £185, so that the cheaply built small car and also good class second-hand motor cars are real competitors to the cycle car movement.

Cycle cars on the road. A G.W.K. and Duo climbing Edge Hill, Warwickshire.

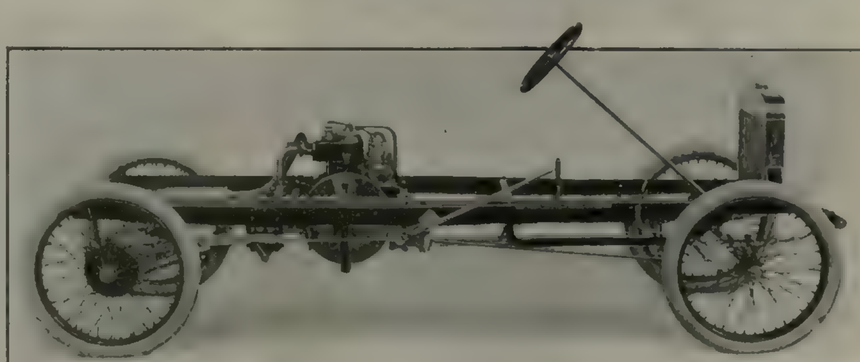
It was in 1912 that serious attention was paid to rejuvenating the light car, and all sorts of names were adopted for it, including spider, carette, runabout, monocar, duocar, and quadcar. Finally, the A.C.U. took the matter in hand and, under the appellation of "cycle car," introduced a definition for that type of vehicle quoted above, though many successful manufacturers refuse to adopt this name, preferring their products called light cars.

As soon as it was learned that a number of important concerns had cycle cars in course of preparation for the 1912 shows, rival concerns hurriedly copied their example, with the result that at the Olympia Motor Cycle Show in December upwards of thirty-four cycle cars were exhibited, but, unfortunate to relate, many were such hurried specimens that striking defects in their design were apparent even to a motorist of but short experience. Wise heads considered the boom a premature one, and it remains to be seen whether the demand will be sustained.

It can be said that there were two distinct types of four-wheelers at the last Olympia Show. One type could be called a true cycle car, in that it embodied motor cycle practice throughout, such as air-cooled engine, belt drive, and expanding pulley gears. These machines mostly had tandem seats, though sociable seats were by no means uncommon. The second type was the miniature motor car which from stem to stern followed big car lines. A light car possessing a four-cylinder water-cooled engine, shaft drive, and a three-speed gear box can hardly be deemed a cycle car, for it embodies none of the adjuncts of a motor cycle, but all the appurtenances of a high-class car. It was the car type of machine which sold in large numbers, not because they were cycle cars, but because they were small and comparatively low-priced cars which embodied well-tried principles throughout. The demand for this type of machine had, however, caught makers napping, and even by the beginning of 1913 only a few makers were ready to deliver in quantities.

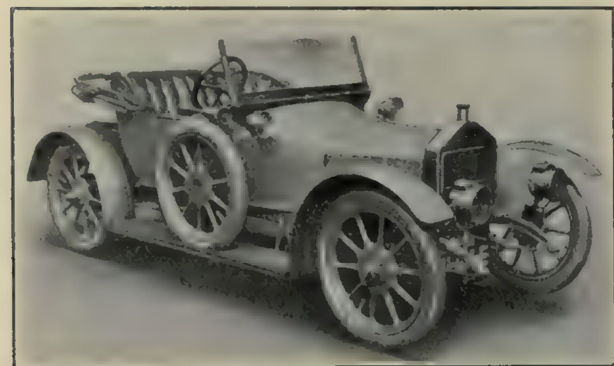
Points of Design.

As regards design, this is by no means settled; in fact, it can be said that in the majority of cases cycle car manufacturers are going over ground covered by the present-day successful car manufacturers eight or ten years ago. Thus we have air and water-cooled engines with from one to four cylinders, though mostly twins, some placed transversely, and in other cases in line with the frame. Change-speed gears nclude all types, such as the miniature sliding type gear box, expanding pulley gears in which the belt rises and falls in the groove of the pulley, thus raising or lowering the gear as desired, and friction drive which allows an infinitely variable ratio between



Chassis of the G.W.K.—a thoroughly proved make of light car. A twin-cylinder vertical water-cooled engine and friction drive are outstanding features.

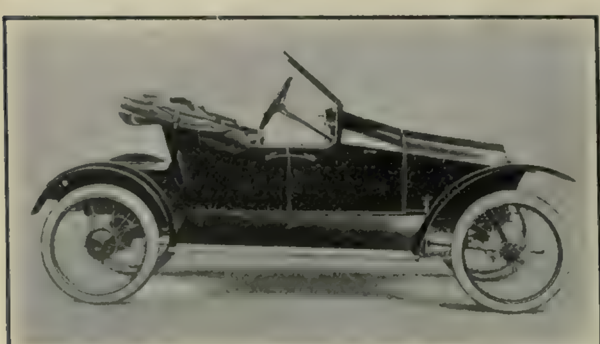
the high and low limits. In the attempt to avoid the use of a differential gear some makers design their cycle cars to drive on one wheel only; others adopt a double drive by means of V belts, relying upon the inner one to slip in turning a corner. It is, however, the miniature cars with weatherproof shaft drive and differential gear that is generally regarded as the type most likely to survive.



The Singer miniature car, which has four water-cooled cylinders, three speeds and shaft drive.

The oiling and control arrangements in many cases leave much to be desired. Motor cycle practice has been copied to such an extent that the unfortunate driver is expected to pump a charge of thick oil into the engine every four or five miles (depending upon the amount of low gear work) and by reason of the fact that the carburetter control as fitted to the handle-bars of motor cycles is used, the throttle and air levers are usually in a difficult position on the dashboard. In many cases, to simplify the control, magneto advance and retard is dispensed with, thus restricting the capacities of the engine.

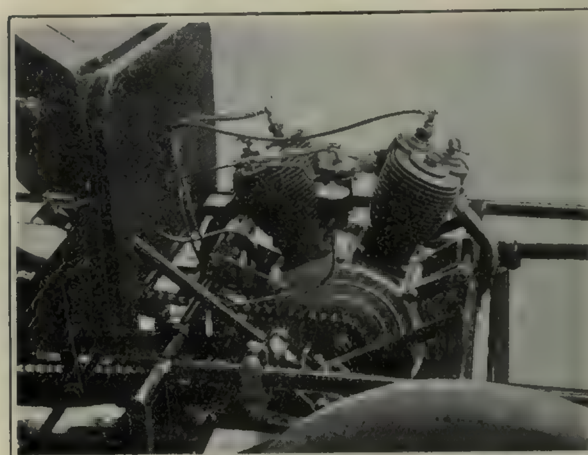
The above remarks likewise apply to the springing, for the ideas of designers on the subject of springing a light and comparatively fast car are widely divergent. Springs arranged transversely, quarter - elliptical springs, semi-elliptical, and threequarter elliptics are some of the types which find adherents among cycle car makers.



The Humberette which with the exception of its V-type twin-cylinder air-cooled engine is a car in miniature.

Another point on which cycle cars may be criticised is the width of the body. In their desire to obtain a light and fast vehicle, makers have built their chassis as narrow as possible, with the result that two average-sized persons adorned in motor coats find themselves somewhat cramped and long runs become a bore. This remark, however, does not apply to all makes. One designer has overcome the objection to restricted seating capacity by staggering the seats, that is, placing the driver about six inches in front of the passenger, which gives a great deal more elbow room.

Tubular frames are the most popular at the present time, though many consider that channel steel frames will ultimately be adopted. In practically all cases wire wheels are adopted, though seldom of the detachable variety, owing to their increased cost, whilst the size is in practically all cases 650 × 65 mm. Even the wheel track is not standardised, some makers preferring a track of 3ft. 4in., others as much as 4ft. For colonial requirements it is undoubtedly true that the narrower types would not be a success, as they would not fit the wheel ruts, and to drive such a



Twin-cylinder V-pattern air-cooled engine of 7-9 h.p., as fitted to the Premier. Transmission throughout is by chain.

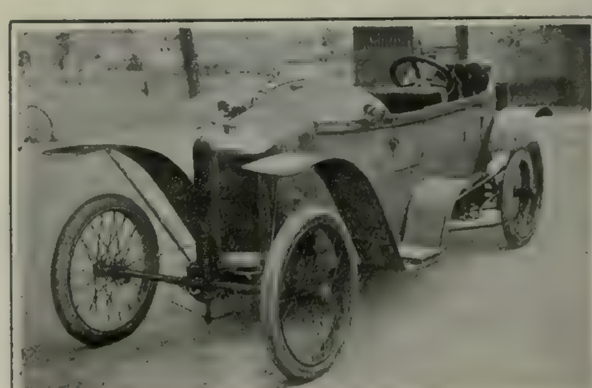
machine along a rutty road which it does not fit is, to say the least, somewhat disconcerting.

At the time of writing it cannot be said that the cycle car has yet attained the reliability of a good motor cycle and sidecar. It is considered by experts that makers have too far studied the speed merchant, and the cycle car's light weight and comparative speed (40 m.p.h. is the usual speed for an 8 h.p. cycle car) have brought other troubles in their wake. 1913 is seeing many reformations in the design of cycle cars.

Condensed Specifications of Some Typical Cycle Cars.

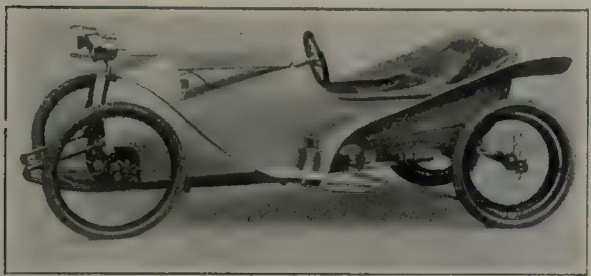
AUTOMOBILETTE.—Two cylinders, 70 × 130 mm.; 1,000 c.c.; water-cooled; three speeds; belt drive; four wheels; weight of chassis, 4 cwts.

SWIFT.—Two cylinders, vertical; 75 × 92 mm.; 972 c.c.; water-cooled; three speeds; shaft drive; four wheels; 7ft. wheelbase; 3ft. 4in. track.



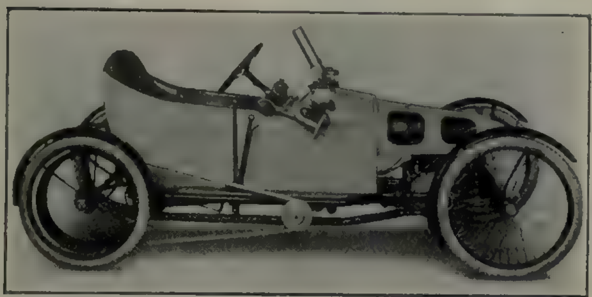
The Automobilette—A typical French tandem-seater.

CRESCENT.—Two cylinders, 50°, 85 × 85 mm.; 964 c.c.; air-cooled; friction drive; four wheels; 7ft. 9in. wheelbase; 3ft. 2in. track; weight of chassis, 5 cwts.



The single cylinder belt-driven Rudge.

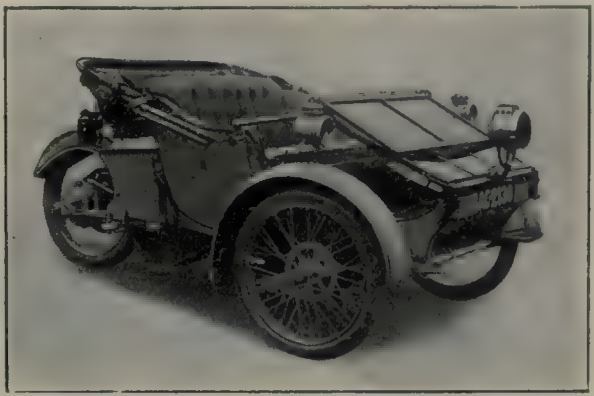
G.W.K.—Two cylinders, 86 × 92 mm.; 1,068 c.c.; water-cooled; friction drive; four wheels; 7ft. 7in. wheelbase; 3ft. 9in. track; weight of chassis, 5¾ cwts.



A single-seated belt-driven cycle car, the Rollo.

SINGER.—Four cylinders, 63 × 88 mm.; 1,096 c.c.; water-cooled; three speeds; shaft drive; four wheels; 7ft. 6in. wheelbase; 3ft. 6in. track; weight of chassis, 6 cwts.

A.C.—One cylinder, 95 × 102 mm.; 723 c.c.; air-cooled; two speeds; chain drive; three wheels; 6ft. 2in. wheelbase; 4ft. 6in. track; weight of chassis, 5 cwts.



Another well tried make—the A.C. sociable—which is a development of the tricar. Single-cylinder air-cooled engine, two speeds and tiller steering are features.

HUMBERETTE.—Two cylinders, 50°, 84 × 90 mm.; 998 c.c.; air-cooled; three speeds; shaft drive; four wheels; 7ft. 3in. wheelbase; 3ft. 6in. track; weight of chassis, 6 cwts.

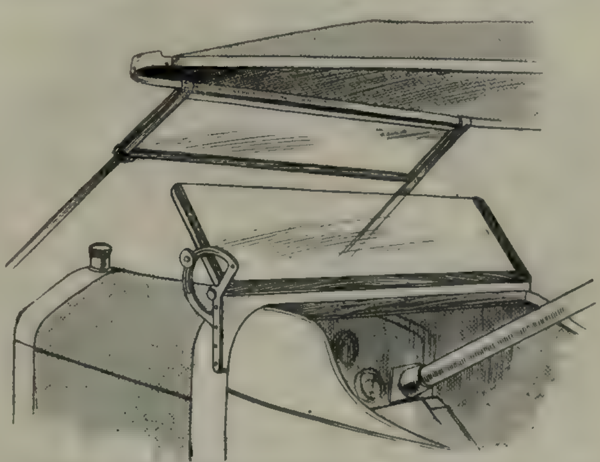
INVICTA.—Two cylinders, 50°, 85 × 85 mm.; 964 c.c.; water-cooled; three speeds; shaft and chain drive; four wheels; 7ft. 9in. wheelbase; 3ft. 11in. track; weight of chassis, 5¾ cwts.

Keeping Out the Rain.

An Article of Special Interest to Colonial Motorists.

MANY motorists who prefer an open car with a Cape cart hood to any closed variety of car, also have a very strong objection to high and heavy wind screens. We must say that, personally, we prefer for all dry-weather work a single screen of such a height that, while we drive normally looking through it, we can, by sitting quite upright, just see over the top of it. Nothing could be more satisfactory than this form of wind screen in dry weather, as, while it shields the face and body from all heavy wind pressure, it creates the minimum of back draught. On the other hand, when one has to face a head wind and rain, the short single screen between the hood and the top of the screen, and, when the weather is really bad, drifts right down the car into the back seats and makes their occupants uncomfortable, as well as nearly blinding the driver and drenching him and his companion.

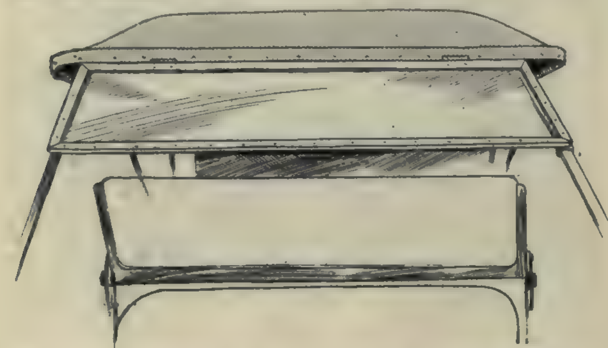
Until now, the only remedy for this, so far as our experience has gone, has been to have a double screen of the type which we always describe as the visor thus: This screen is made in halves and can be used in a variety of ways, but it is necessarily somewhat cumbersome, and, so far as our requirements are concerned and those of many of our readers, is only wanted in wet weather; that is to say, it is always used doubled down at half screen height except in the wet, and then it is put up and used as a visor, *i.e.*, both bottom and top halves sloping outwards, so that there is a space, or mouth, between the two



Position of the main screen and the top supplemental screen as seen when standing on the left of the car and looking forward. This gives an idea of the width of the clear space between the two screens, and wide as it is no wet comes in.

Keeping Out the Rain.

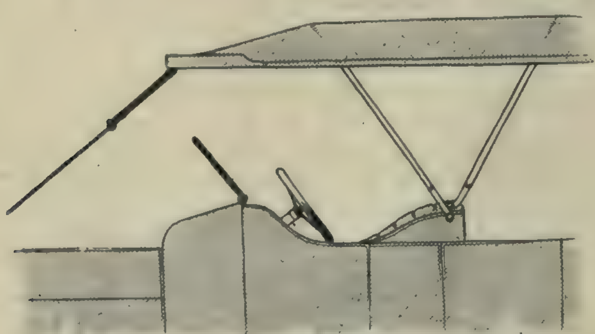
halves of the screen, through which the driver looks. The width of the mouth and the angles of the two halves are, of course, adjusted to suit the individual driver and car. In this form the visor screen is entirely satisfactory, as it gives a clear view ahead and at the same time keeps practically all wet out of the car, only an occasional drop coming in, and the screen can be so adjusted that these occasional drops do not hit the eyes or, what is still more important, the glasses of the driver should his vision be not normal.



Front view of the main screen and light supplemental celluloid screen hung from the hood.

We have tried all sorts of dodges in order to obtain the advantages of the visor screen in wet weather and at the same time be able to use our ordinary single screen for dry-weather work. Up till last year all these attempts have failed, but our last effort has been successful—indeed, it is as good as, or better than, the best visor screen we have ever sat behind.

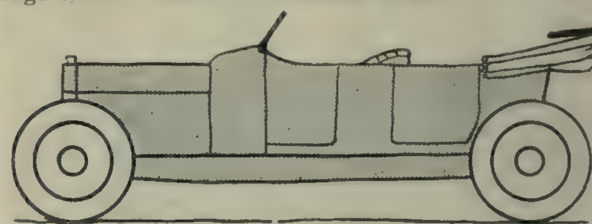
First of all, the wind screen proper is an ordinary hinged single screen, which in fine weather is sloped backward a little and is perfectly satisfactory. The addition for wet weather has nothing whatever to do with this screen, but is an attachment to the hood. On our particular car it consists of a sheet of trans-



A diagrammatic view of the position of the main screen and the supplemental screen when in use.

parent celluloid held in a very light wood frame. It is strapped to the front of the hood by a couple of light straps, and lies upon the main hood straps, to which it is also lightly attached by two more straps. It will be seen that the connection between the celluloid screen and the hood is quite flexible, and when the hood is turned back there is no need to detach it; we simply loosen the two top straps a little so that it lies flat upon the top of the hood and quite out of the way. It might be thought necessary to have some sort of flexible watertight joint between the frame of the celluloid screen and the front edge of the hood, but this does not seem to be necessary so long as it is strapped up closely to the hood, as the rain at this point blows off and not into the car.

When driving in the rain, the hood is put up in the usual way, the two top straps holding the celluloid frame to the hood are tightened up, and the car wind screen is then sloped forward to a convenient angle, so that the driver can see over it easily. This gives a clear, open slot of about 2½in.—the full width of the screen—but not a drop of water finds its way back, and one can drive at high speeds into heavy rain without any wet coming into the car. Incidentally, too, all swirling draughts in the back seats are abolished. Occasionally, in very heavy rain, drops of water collect on the bottom edge of the celluloid screen and blow back, but the cross current from the under screen cuts nearly all of them off, and they are thrown down harmlessly. Now and then one of these drops may come back into the car, but it is always below the line of sight or else well above it. This is so rare an occurrence, however, that it is hardly worth troubling about, but to obviate it in future we have fitted a very light brass gutter along the lower edge of the frame of the celluloid screen.

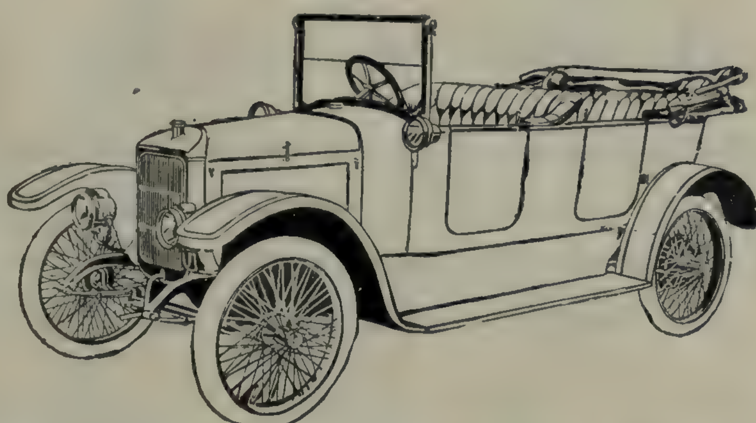


In fine weather the main screen is set at a slight backward angle on the dashboard while the supplemental extension screen hinges inward and reposes comfortably on the top of the folded hood. The two screens are indicated in the diagram by thick black lines.

We should say that almost equally satisfactory results could be obtained with a canvas extension to the hood, provided the bottom edge were kept stiff by a light strong piece of wood within it like the bottom of a window blind. Indeed, the whole principle of a roller blind might be adopted if preferred. It would not really matter about the top part of the screen being opaque, as no one looks through it in driving; in fact, in heavy rain it is obscured by wet. On the other hand, it would make the car rather dark, so that the celluloid device is preferable.

The Swift light car on the road *see page 91).*

THE Stoneleigh LIGHT CAR.



THE STONELEIGH LIGHT CAR particularly appeals to that large class who desire a strong, smart, economical car, at a really moderate and inclusive figure. The Stoneleigh, ready for the road, sells in England for £350. It is made by one of the largest motor works in Great Britain, and is guaranteed by the Siddeley-Deasy Motor Car Co., Ltd., of Coventry.

BRIEF SPECIFICATION.

Knight Sleeve Valve Motor (4 cylinder) 75 mm. bore, 114 mm. stroke; worm drive; 3 speeds. Smart torpedo body; "one-man" hood; 5 detachable wire wheels and tyres (1 non-skid); 3 electric lamps; 2 head lamps; horn; tools; etc.

Prices upon application.

THE SIDDELEY-DEASY MOTOR CAR CO., LTD.,

COVENTRY, ... ENGLAND.

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THE

Stoneleigh

Commercial Vehicle.

A NEW chassis to carry 30 cwt. of dead load, embodying in its production high class design, material, and workmanship, thus ensuring reliability and low maintenance charges. The Road clearance is high—10 inches. Read the specification—fuller particulars will be sent upon application.

SPECIFICATION.

16 h.p. 4-cylinder Silent Knight Sleeve Valve Motor; Silent worm drive; 10 inch road clearance; steel wheels. Extremely simple, totally enclosed transmission of a new type. To carry loads of 30 cwt., or suitable for a small omnibus or char-a-banc body to carry ten people.

GUARANTEED BY THE PROPRIETORS.

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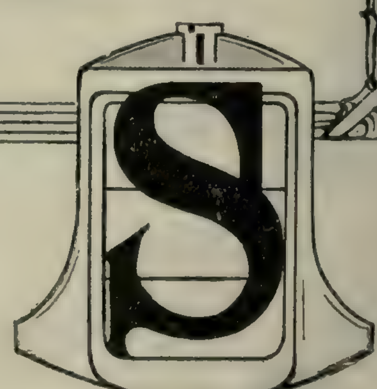


GODBOLD

R.A.C. Certified Trials of Accessories and Tyres.

During 1912 the Royal A.C. undertook a number of individual tests of accessories and cars. These trials are always interesting, and the official certificates of performance are well worth retaining for reference. Below will be found a summary of the reports issued of all the trials held in 1912, other than those of cars.

Gautier Metallic Fabric Tyre.

ENTERED for a 3,000 miles trial by the Gautier Metallic Fabric Tyre Syndicate, Ltd., 8, Great Marlborough Street, W., January 16th-18th, 1912. From the certificate, it appears that the tyre was a pneumatic of the usual form, except that in place of canvas the carcase of the outer cover was formed of two super-imposed diagonal layers of small chain of the type consisting of flat side-plates joined by transverse rivets. Each of these chains ended in wire hooks which passed into the bead of the tyre. The tyre was lined with canvas and had the usual rubber tread. The country of origin was England. The tyre (outer cover only) weighed 67 lbs. One 880 mm. × 120 mm. tyre was entered and was fitted on the rear off wheel (detachable flange rims being used) of a 27.3 h.p. (R.A.C. rating) Schneider car. The weight of the car was 1 ton 14 cwt. 1 qr. 24 lbs. (back axle 19 cwt. 0 qr. 2 lbs.; front axle 15 cwt. 1 qr, 22 lbs.). The average weight of the load was 508 lbs., making the average running weight 1 ton 19 cwt. The tyre was inflated to a pressure of 70 lbs. per square inch. The trial was held upon Brooklands track. After 208 miles had been covered the tyre suddenly deflated. It was found that the bead had become detached from the cover. The tyre was withdrawn from the trial.

A further test was made from February 19th to 27th of two tyres of the same make (outer covers only), weighing 78¾ lbs. and 76¼ respectively. The tyres were fitted to the two back wheels (detachable flange rims being used) of a 27.3 h.p. (R.A.C. rating) Schneider car. The weight of the car was 1 ton 13 cwt. 2 qrs. 26 lbs. (back axle 18 cwt. 1 qr. 5 lbs.; front axle 15 cwt. 1 qr. 25 lbs.) The average weight of the load was 526 lbs., making the average running weight 1 ton 18 cwt. 1 qr. 20 lbs. These tyres were inflated to a pressure of 72 lbs. per square inch. The trial was held upon Brooklands track. From the start of the trial it was found that the edges of the rims were tending to cut into the bead of the tyres. After 363 miles had been covered, the bead of the near rear tyre became detached from the cover and the tyre deflated. The tyres were withdrawn from the trial, the entrant giving as the cause of the failure, incorrect relative sizes between beads of the tyres and the edges of the rim.

Atlas Impulse Tyre Pump.

Entered by the Atlas Non-puncture Inner Case Syndicate, Ltd., 124, High Street, Kensington, London, W. The trial took place on January 19th, 1912.

The device was tested on a 15.9 h.p. (R.A.C. rating) F.I.A.T. car, the dimensions of the four cylinders of the engine of which were 80 mm. × 130 mm. Except in one case, the weight of the car—2,788 lbs. (front axle 1,206 lbs., back axle 1,582 lbs.)—was upon the tyres during inflation. The tyres used in the tests were 815 × 105 mm.

The device was fitted to the engine, ready for inflation, in an average time of 52.9 seconds from the time the bonnet was lifted. The fastest time was 44⅗s. No tool was used to secure the device in the engine cylinder.

Five inflation tests were made, the tyres being pumped to a pressure of 70 lbs. per square inch.

The following are the times taken: No. 1.—Off front, 3m. 48⅕s.; No. 2.—Off back, 3m. 50⅕s.; No. 3.—Near back, 4m. 2⅗s.; No. 4.—Near front, 3m. 39⅘s.; No. 5.—Off front, 3m. 8⅘s.

The engine speed in tests Nos. 1 to 4 was about 400 revolutions per minute. This was increased to about 450 revolutions per minute in test No. 5. The first four tests were carried out in quick succession. In test No. 5 the weight of the car was not upon the tyre during inflation. During test No. 1 the tubing and gauge were found to be defective and were replaced by another with which the tests were carried out. When the air passing from the end of the tyre connection had been allowed to impinge from a distance of one inch upon a piece of white blotting paper for a period of four minutes (i.e., about the time taken to inflate one tyre), a slight amount of oil was visible upon the paper.

Warland Dual Rim.

Entered by the Warland Dual Rim Co., Ltd., Alma Street, Aston, Birmingham. Date of trial: January 23rd to February 7th, 1912. Distance, 2,000 miles on the road.

The four rims complete were tested on a 24.8 h.p. (R.A.C. rating) De Dion Bouton car. The weight of the car was 4,448 lbs. (1 ton 19 cwt. 2 qrs. 24 lbs.); front axle, 2,249 lbs.; back axle, 2,199 lbs. The average running weight throughout the trial was 5,109 lbs. (2 tons 5 cwt. 2 qrs. 13 lbs.).

The trial was held upon the Club's six standard routes. The average speed (running time only) was 19.6 m.p.h. The weather was fine, some rain and snow being encountered on three days. The roads were fair. On four occasions the car was driven through flood waters about 6in. deep. During the trial 2,002 miles were covered, throughout which no repairs or adjustments to the device were done. Cord tyres were used, the dimensions being 880 mm. × 120 mm. The near back tyre was steel studded, the remaining three being ribbed.

Of the four complete rims and tyres the near back remained untouched in position upon the wheel for the whole of the trial, while the other three rims with their tyres were intentionally changed, wheel for wheel, thirty-three times.

During the trial the following operations were performed and timed: (1) Removing tyre from rim, (2) fitting tyre to rim, (3) changing cover and air tube for other cover and air tube, (4) removing rim and tyre from wheel, (5) mounting rim and tyre on wheel, and (6) changing rim with tyre for other rim with tyre. In all cases the times shown are for the actual work necessitated, but do not include jacking up the car, preparing tools, inflation, or fitting the valve dust cap. One man only was employed on the work, and the times are given below:

Operations.	No. of times timed.	Shortest time taken. M. S.	Longest time taken. M. S.	Average time taken M. S.
1. Tyre removed from rim ...	14	0 40⅘	1 37	0 58.3
2. Tyre fitted to rim ...	12	0 47⅘	1 23⅖	1 3.1
3. Changing cover and tube (times obtained by adding 1 and 2)	—	1 28⅗	3 0⅖	—
4. Rim with tyre removed from wheel	37	0 27⅖	1 32⅘	0 41.5
5. Rim with tyre fitted on wheel	33	0 31⅗	1 57⅘	1 15.4
6. Changing rim with tyre (times obtained by adding 4 and 5)	—	0 59	3 30⅗	—

In addition to the above operations, three new cord tyres (two metal studded and one ribbed), sealed, as received from the manufacturers, were fitted to rims. The following were the times taken. They are not included in the above table:

Metal studded	5m. 43⅘s.
Ditto	1m. 23s.
Ribbed	3m. 48⅖s.

The first of these times was lengthened through the handle of the tool fouling the bead of the tyre. It also does not include the fitting of the nut on the bolt valve.

The time taken to dismount the near back rim with tyre (undisturbed for 2,002.5 miles) was 1m. 5⅕s., while 1m. 33⅕s. was taken to remove the cover and air tube from the rim. During this dismounting of the rim with tyre the central portion of the valve was wrenched away from its socket through catching in the hole in the felloe on the wheel.

After the trial all rims and component parts were in good condition, except that a rivet between the fixed flange and the bonding band on the near rear wheel had come out. The rims were not rusty, with the exception that the adjacent edges of the rim sections where they were in contact showed signs of rust. There was a small amount of dry mud on the underneath side of the rim and on the adjacent parts of the near back wheel. Water had not entered beneath the beads, or within any of the outer covers. There was no creeping, either of tyres or rims. The air pressure was 40 to 50 lbs. per square inch.

"M" Tyres.

Entered by Mr. D. Maggiora, Hackbridge Park, Hackbridge. Held on the Brooklands track, May 10th-13th, 1912.

The construction of the tyre (which is fitted into the usual outer cover and displaces the air tube) is as follows:

Over a central rubber core three rubber sleeves are successively telescoped, one over the other. The internal diameter of each sleeve is considerably smaller than the sleeve (or, in the case of the first sleeve, of the core) over which it is forced. By this means the core is greatly distorted, being increased in length and decreased in cross section. In

R.A.C. Certified Trials.

practice the sleeves are forced on in sections about a foot long. The resulting long cylinder of rubber is cut to such a length that when the ends are brought together it can be forced into the outer cover, the beads of which are then held in place by a divisible rim.

The weight of the "M" filling, compared with that of an air tube and security bolts, but not counting the weight of the divisible rim necessitated, is 35 lbs., as against 5 lbs. 15 ozs.

DESCRIPTION OF TRIAL.—The tests, which were held upon Brooklands track, were run (*a*) with "M" fillings in 875 mm. × 105 mm. Palmer ribbed covers, and (*b*) with 920 mm. × 120 mm. Michelin square-tread pneumatic tyres.

In each case the same car was used, a 52.1 h.p. (approximately) R.A.C. rating Isotta-Fraschini, weighing (with "M" tyres) 3,994 lbs., *i.e.*, back axle 2,081 lbs., front axle 1,913 lbs. The pneumatic tyres were inflated to a pressure of 65 lbs. per square inch (front), and 70 lbs. per square inch (back).

Two pairs of tests (pneumatic and "M" tyres) were made. In each test the throttle and ignition levers of the car were fixed at the same position—not that of maximum speed. The engine was at approximately the same temperature prior to each individual test. Owing to the difference in the size of the outer covers used in the "M" and pneumatic tests, the effective gear ratio of the car was raised, in the case of the latter by 3.46%. The distance travelled was, in each case, about seventeen miles.

The following are the results of the tests:

Tyres.	Speed m.p.h.	Petrol consumption m.p.h.	Surface temperature of tyre	Temperature of air.
"M"	35.79	18.58	34.5° C.	19.5° C.
*"M"	34.09	18.48	34.0° C.	19.25° C.
Pneumatic	32.72	17.98	55.0° C.	19.75° C.
*Pneumatic	31.93	17.95	58.0° C.	19.5° C.

*Note.—In these tests an extra passenger, weight 201 lbs., was carried.

Comparative resilience tests were made. In each case a 40 lb. weight was allowed to drop from a height of 2ft. on to the tyre, and the amount of yield and return was measured. The following are the averages of the results obtained:

Tyres.	Yield.	Return.
"M"	1 in.	$13\frac{15}{16}$in.
Pneumatic	$1\frac{1}{4}$in.	$17\frac{5}{16}$in.

Kellog Air Pump for Tyre Inflation.

Entered by Mr. Arthur H. Marshall, 55, Lincoln's Inn Fields, London, W.C., and held on June 8th, 1912.

The device consists of a four-cylinder air compressor. The cylinders are provided with non-return valves in the heads, and air is drawn into the cylinders through holes situated at their lower end. These holes are uncovered by the piston on reaching the bottom of its stroke. The pistons are of cast-iron fitted with leather cups on the heads. A shaft provided with eccentrics actuates the pistons through connecting rods. The cylinders of the pump are $1\frac{7}{16}$in. bore by $1\frac{1}{8}$in. stroke. The weight of the pump, excluding necessary gear wheels or clutches, is 9 lbs. The country of origin is the United States of America.

The device was fitted as an integral part of the car to an extension of the gear box of a 32.4 h.p. (R.A.C. rating) Peerless car, weighing 4,375 lbs. The pump was put into action when required by a clutch, the actuating lever of which was brought to the side of the car. The pump ran at the same number of revolutions as the engine. The tyres fitted to the car were 36in. × 5in., and the near front tyre was inflated to a pressure of 90 lbs. per square inch in 2m. $1\frac{3}{5}$s. The wheel was supported on a jack, and the engine was running at 500 revolutions per minute. When the air passing from the end of the tyre connection was allowed to impinge from a distance of 1in. upon a piece of white blotting paper for a period of four minutes a small amount of oil was deposited on the paper.

Cadillac Engine Starting Device.

Entered by F. S. Bennett, Ltd., 219-229, Shaftesbury Avenue, W.C. Date of trial: July 19th and 20th, 1912.

The device consists of an electric generator driven by the engine. The generator charges a twenty-four volt battery. For starting purposes the dynamo is temporarily connected up to the battery as a motor, at the same time being put into gear (through the medium of the clutch pedal) with teeth cut on the periphery of the flywheel. When the clutch pedal is released, on the engine starting, the electrical machine is disconnected from the flywheel.

Three cars were tested. The numbers of fifteen cars were handed to the Club, of which three were selected and the cars placed under observation. After selection the electrical controllers and batteries were fitted. The three cars were then timed for the initial starts. These times were $4\frac{1}{5}$s., 3s., and $4\frac{1}{5}$s. respectively. The throttle and ignition positions of the cars were then set to a fixed position and one thousand starts per car were made. The interval between each start was approximately ten seconds, and each engine was allowed to run under its own power for, approximately, two seconds after it had commenced to fire. The engines were stopped in each case by switching off. The ignition control was set in such a position that it was not possible to start "on the switch."

The approximate average time taken for each engine to start after depressing the clutch pedal was four-fifths of a second.

The 1,000 starts were made without any hesitation at any time, and on no occasion did the starter fail in operation.

The voltage of the batteries of the three cars before the trial was 24.8, 25.8, and 25.1 respectively, while after the 1,000 starts it was 24.79, 25.28, and 24.60 respectively.

Stewart-Morris Paraffin Carburetter.

Entered by the Stewart Precision Carburetter Co., Ltd., 199, Piccadilly, London, W. Distance: 2,000 miles. Date of trial: August 13th to September 11th, 1912.

The weight of the carburetter, not including the vaporiser within the exhaust manifold, but including the pipes leading thereto, was nine pounds.

The carburetter was fitted to a 27.3 h.p. (R.A.C. rating) Pathfinder car. The following are the particulars of the car:

Weight: Front axle, 13 cwt. 1 qr. 23 lbs.; back axle, 17 cwt. 2 qrs. 3 lbs.; total weight 30 cwt. 3 qrs. 26 lbs.; average weight of load during trial, 3 cwt. 0 qr. 20 lbs.; average total running weight, 34 cwt. 0 qrs. 18 lbs.; bore and stroke of engine, 105 mm. × 133 mm.; number of cylinders, 4; gear ratio on top gear, 3.7 to 1; size of tyres, 34in. × 4in.; wind area of body, 14. sq. ft.

Petrol and paraffin pipes led to a three-way cock on the heel-board, thence to the carburetter. The pressure was not sustained automatically, but by means of a hand pump. The pressure was not kept constant, but was usually between 5 and 6 lbs. per sq. in. It was increased when approaching any considerable hill, and was put up to 7 lbs. per sq. in. up Sunrising Hill.

The control was by throttle and cold air lever. The latter was not used much—on an average about three times a day.

On some occasions when the engine was started on petrol a device was employed which allowed petrol to be injected directly into the induction pipe.

The paraffin oil used was an oil marketed by Messrs. Carless, Capel, and Leonard as "Phœbus" oil. Its specific gravity was .807 at 13°C.

The following is a synopsis of the methods by which the engine was started during the trial:

The engine was started direct on paraffin twenty-three times, the longest stop after which this was done being seventeen minutes. On four occasions unsuccessful attempts were made to start on paraffin direct.

On nine occasions the engine was started on paraffin, petrol having previously been injected into the induction pipe, the longest stop after which this was done being forty-five minutes.

The engine was started on petrol twenty-one times, the shortest period after which the fuel was changed to paraffin was ten seconds, the longest being four minutes twenty seconds. The variation in this time appeared to be dependent upon the duration of the previous stop. On six occasions the engine stopped when the change of fuel was made, being, however, subsequently re-started on paraffin.

The total distance covered during the trial was 2,003.3 miles, 1,001.0 miles being run upon the road upon the Club's six standard routes and 1,002.3 miles upon Brooklands track.

ROAD TRIAL.—The average speed (running time only) was 19.8 miles per hour. The quantity of paraffin used was 47.88 gallons, being a consumption of 20.91 miles per gallon or 35.70 ton-miles per gallon.

1.05 gallon of petrol was used during the road portion of the trial.

BROOKLANDS TESTS.—The 1,002.3 miles upon the track were covered at an approximately constant speed of 35 miles per hour. The paraffin consumed was 46.41 gallons, being a consumption of 21.59 miles per gallon or 36.88 ton miles per gallon. 0.76 gallon of petrol was used during the track portion of the trial.

SLOW ENGINE-SPEED TEST.—The engine was run idle for ten minutes on paraffin at an average speed of 352 revolutions per minute. The speed during this time was very regular, and no misfiring was apparent. At the end of this period the throttle was opened to its fullest extent as quickly as

possible, the ignition at the same time being advanced more slowly. The engine accelerated regularly, without hesitation or misfiring.

SLOW CAR-SPEED TEST.—The car was driven, on paraffin, on top gear for 1.5 miles at an average speed of 6.14 miles per hour, the speed being kept as constant as possible. The car was then accelerated, 39.2 miles per hour being attained in 51s. The engine fired regularly during the slow running except during the last 200 yards, when there was occasional misfiring.

CONSUMPTION TESTS.—The following tests of the consumption of paraffin were taken:

Speed.	Consumption.	
m.p.h.	Miles per gallon.	Ton-miles per gallon.
10.6	23.12	39.48
14.9	23.81	40.66
20.1	26.69	45.58
25.2	27.19	46.44
30.45	23.94	40.89
35.8	17.45	29.81

HILL TEST.—The car was timed up the test hill, the speed being 11.16 miles per hour. The weight of the car and load in this test was 31 cwt. 3 qrs. 1 lb.

CONDITION AFTER TRIAL.—There was a somewhat considerable amount of deposit upon the piston heads of No. 1 and No. 4 cylinders, while that on the piston heads of No. 2 and No. 3 cylinders was not so great. The cylinder heads and valve ports had slight deposit, but were somewhat sooty. The valves had no deposit, but were somewhat sooty. The sparking plugs were slightly sooty. The engine showed signs of over-lubrication.

GENERAL REMARKS.—Throughout the trial there was no misfiring, with the exception of that mentioned in the slow car-speed test. During the trial 1m. 1⅗s. was taken to check the adjusting nuts of the taper needle. With this exception no work was done upon the carburetter or upon the engine. Throughout the trial, except for engine starting, the car was driven upon paraffin fuel.

On one occasion the engine suddenly stopped upon a hill. The fuel pressure was at the time 4½ lbs. per sq. in. The engine subsequently was restarted by engaging the reverse gear.

Gautier Metallic Fabric Tyre.

Entered by the Gautier Metallic Tyre Syndicate, Ltd., 27a, Bangalore Street, Putney, London, S.W. Distance, 3,000 miles, but subsequently increased to 4,000 miles. Date of trial, June 17th-September 13th, 1912.

The tyres were pneumatic tyres of the usual form, except that in place of canvas the carcase of the outer cover was formed of two superimposed diagonal layers of small chain, of the type consisting of flat side-plates joined by transverse rivets. The distance between the rivet centres was 10 mm., while the width of the chain was 4.5 mm. Each of these chains ended in wire hooks, which passed into the bead of the tyre. The tyre was lined with canvas, and had the usual rubber tread with canvas support. To assist in attaching the tread to the carcase, a large number of metal clips are provided, which pass round the chains in the outer layer and through the canvas support of the tread. The country of origin is Great Britain.

The dimensions of the tyres were 880 mm. × 120 mm. square tread. The covers weighed 77¼ lbs. and 77 lbs. respectively. They were fitted to the back wheels of a 27.3 h.p. (R.A.C. rating Schneider car live axle. The weight of the car was 1 ton 15 cwt. 0 qr. 3 lbs. (back axle 19 cwt. 0 qr. 19 lbs.; front axle, 15 cwt. 3 qrs. 12 lbs.). The average weight of the load was 4 cwt. 1 qr. 15 lbs., making the average running weight 1 ton 19 cwt. 1 qr. 18 lbs. The tyres were inflated to a pressure of 70 lbs. per square inch for the first 1,113 miles, the pressure then being increased to 80 lbs. per square inch. Standard air tubes, security bolts, and rims were used.

The trial was held upon Brooklands track. The average speed throughout the trial was 25.3 miles per hour. The two tyres travelled 4,006.6 miles and 3,610 miles respectively.

TYRE No. 1.—After running 385 miles the cover was removed from the rim, and narrow strips shaved off the beading, to allow the latter to fit the rim better. At 543 miles the tread and its canvas support were found to be loose on the chains for the whole circumference of the tyre. The tyre was retreaded. After vulcanising, a piece of the tread, 5in. × 1½in., found to be loose on the canvas support, was repaired, a piece of the canvas lining of the cover, 8in. × 3in., which was loose, being also repaired.

At 643 miles, when the cover was removed from the rim for examination, the canvas lining of the cover was found to be splitting. At 750 miles the cover was again removed from the rim for examination, and ten canvas patches were applied to the canvas lining where it was splitting.

At 909 miles the rubber tread was found to be loose on the canvas support for the whole circumference, the canvas support itself also being loose on the chains in places. The tyre was retreaded, the canvas lining being replaced.

At 2,062 miles four small cuts in the tread were plugged and cold vulcanised.

At 2,893 miles a cut in the tread, 2in. long, was repaired with a portable vulcaniser.

At 3,413 miles the cover was again retreaded and a new canvas lining fitted. At the same time, 41 chains in the outer layer were repaired by replacing 56 links.

In the inner layer of chains 58 chains were repaired, 69 new links being used. For the remaining 594 miles no work was done. In addition to the work mentioned above, the tyre was removed once for examination.

TYRE No. 2.—After running 1,113 miles the tyre was found to be deflated and much heated. The cause of the deflation was found to be a faulty air tube. The rubber tread and its canvas support were found to be loose on the chains. The cover was retreaded, the canvas lining being renewed.

At 1,204 miles a piece of the tread was found to be loose. It was cut open and cold vulcanised.

At 1,310 miles a strip of the tread fifteen inches long (including that mentioned above) was renewed in sections, a portable vulcaniser being employed.

At 1,381 miles this strip of tread was again found to be loose. This part of the tread (twenty-four inches long) was renewed and the cover revulcanised.

At 2,057 miles five small cuts were cleaned, plugged, and cold vulcanised.

At 2,868 miles several cuts in the tread were cleaned, plugged, and cold vulcanised, while the same treatment was repeated at 2,879 miles.

At 2,887 miles, owing to the rubber tread and the canvas support becoming loose, the cover was retreaded and a new canvas lining fitted.

In eleven chains in the outer layer sections about 4½ inches long were replaced owing to fracture or wear, while four new links were put into chains of the inner layer.

At 3,541 miles the tyre deflated, owing to some chains breaking and puncturing the air tube. Canvas was placed inside the cover and a new air tube was fitted.

At 3,610 miles the cover was withdrawn from the trial. In addition to the above-mentioned work, the tyre was removed twice for examination.

The covers were examined after the trial. In each there were, apparently, a number of broken chains, these causing bulges on the walls of the covers.

GENERAL REMARKS.—The temperature of the tyres rose on an average 35° C. above that of the atmosphere. The greatest rise recorded was 47.5° C. above that of the atmosphere. This rise was not that caused by the deflation mentioned in the record of tyre No. 2.

For a third of the trial the surface of the track was wet.

At intervals during the trial the tyres were changed wheel for wheel, but were always upon the back wheels.

Stewart-Morris Paraffin Carburetter (Town Traffic Test).

Entered by the Stewart-Precision Carburetter Co., Ltd., 199, Piccadilly, London, W. Date of trial, November 12th. 1912.

The weight of the carburetter, not including the vaporiser within the exhaust manifold, but including the pipes leading thereto, was 9 lbs.

The carburetter was fitted to a 27.3 h.p. (R.A.C. rating) Pathfinder car. The following are the particulars of the car: Weight—Front axle, 13 cwts. 1 qr. 17½ lbs.; back axle, 16 cwts. 2 qrs. 4½ lbs.; total weight, 1 ton 9 cwts. 3 qrs. 22 lbs.; average weight of load during trial, 3 cwts. 0 qr. 2½ lbs.; average total running weight, 1 ton 12 cwts 3 qrs. 24½ lbs.; bore and stroke of engine, 105 mm. × 133 mm.; number of cylinders, 4; gear ratio on top gear, 3.7 to 1; size of tyres, 34in. × 4in.

The carburetter was fitted in the usual place. The paraffin tank was fitted between the rear spring-hangers, the fuel being lifted to the carburetter by pressure. The pressure was maintained automatically in the usual way. The petrol for starting was carried in a small tank in the boot, the same pressure system being used for both fuels. Petrol and paraffin pipes led to a three-way cock on the heel-board, thence to the carburetter.

The cubical content of the compression space of a cylinder of the engine was 368 c.c., and the cubical content of the volume swept by a piston was 1,152 c.c., giving a compression ratio of 4.13.

R.A.C. Certified Trials.

The paraffin oil used was an oil marketed by Messrs. Carless, Capel, and Leonard as Phœbus oil. Its specific gravity was .807 at 13° C.

A sample of the fuel used was subjected to a distillation test, and the following is the result of the test, and also of one of ordinary commercial burning oil:

	Phœbus.	Ordinary.
10% distilled at	140° C.	152° C.
20% ,,	151° C.	164° C.
30% ,,	160° C.	181° C.
40% ,,	165° C.	198° C.
50% ,,	172° C.	209° C.
60% ,,	180° C.	229° C.
70% ,,	190° C.	243° C.
80% ,,	203° C.	261° C.
90% ,,	225° C.	280° C.

The route followed during the trial was between Russell Court and Bow Bridge, E., *viâ* Pall Mall, Cockspur Street, Trafalgar Square, Strand, Fleet Street, Ludgate Hill, St. Paul's Churchyard, Cannon Street, Queen Victoria Street, Mansion House, Lombard Street, Fenchurch Street, Aldgate, Whitechapel Road, Mile End Road, and Bow Road.

The length of the double journey was 11.6 miles. This was covered six times, making a total distance of 69.7 miles.

The trial started at 8.25 a.m., and ended at 7.15 p.m. There were voluntary stops for lunch, etc., totalling 2h. 16m., during which the engine was stopped, and, in addition,

The fuel had a specific gravity of .732 at 60°F. The following is the result of a distillation test:

10% distilled at	57.8°C.	50% distilled at	114.4°C.
20% ,, ,,	74.4°C.	60% ,, ,,	171.1°C.
30% ,, ,,	95.0°C.	70% ,, ,,	208.9°C.
40% ,, ,,	113.3°C.	80% ,, ,,	233.3°C.

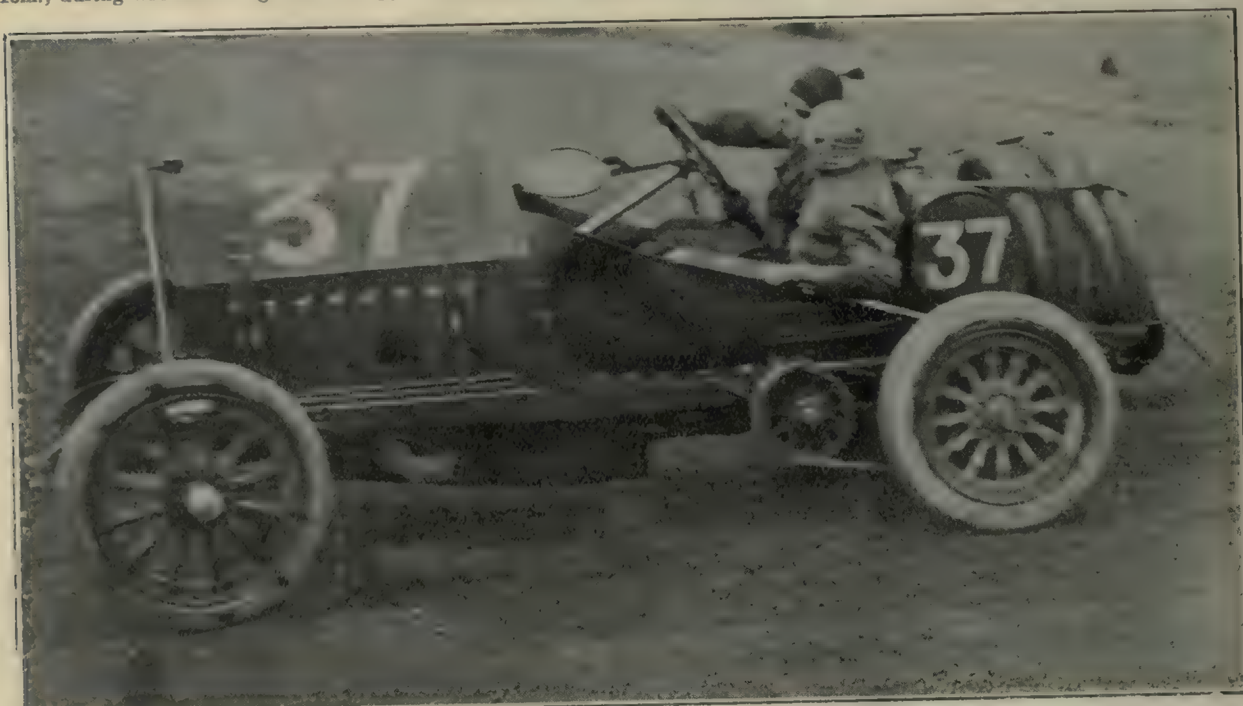
The car used was a 24.8 h.p. (R.A.C. rating) Panhard, with Knight sleeve-valve engine, the dimensions of which were 100 mm. × 140 mm. The wind area of the car was 13.9 square feet.

The weight of the car was 27 cwts. 13 lbs., and the running weight, with passenger, 30 cwts. 1 lb. The trial was held upon Brooklands track. The weather was fine.

The following are the results of the tests:

Test No.	Speed. m.p.h.	Consumption. Miles per gall.	Ton-miles per gall.
1	15.9	11.25	16.87
2	20.1	9.99	14.99
3	25.1	11.49	17.24
4	30.4	13.87	20.81
5	34.3	13.25	19.87
6	37.9	13.99	20.99

During tests Nos. 1, 2, and 3 much white smoke issued from the exhaust pipe. There was popping in the carburetter during test No. 6.



One of the 200 h.p. F.I.A.T. cars taking a corner in the 1912 Grand Prix. This is the car driven by the late David Bruce-Brown, whose magnificent driving and work at the pits will long be remembered in connection with the big race.

sixty-four traffic stops, varying in length from 2s. to 1m. 45s., and one longer one of 7m. The time occupied by these sixty-five stops was 28m. 46s., during which the engine was kept running.

The average speed (running time only) was 8.62 m.p.h. The quantity of paraffin used was 6.06 gallons, being a consumption of 11.497 miles per gallon, or 18.95 ton-miles per gallon.

At 63.7 miles, fifty yards after restarting after a voluntary stop, the engine stopped, causing a 45s. stoppage of the car while it was restarted. The pressure was at the time 5 lbs. per square inch. On two occasions the engine stopped on declutching, but was restarted by the clutch without stopping the car.

General Remarks.—The weather was cold and damp during the trial, and slight rain fell for the last 2½ hours.

There was no misfiring throughout the trial.

The temperature of the cooling water was taken at midday, and was found to be 94° C. No water was added during the trial.

The Irresistible Circulator (Water Circulating Device).

Entered by the Irresistible Circulator Co., Ltd., 42, Fairlawn Park, Chiswick Park, London, W.

The device was fitted to a 22.4 R.A.C. rating Bedford car, and the trial took place on November 11th, 1912.

The device consists of a tube leading from the rear end of the exhaust manifold to the top water-pipe about eight inches before it enters the radiator. The tube enters the water-pipe at an angle sloping towards the direction of flow (*i.e.*, towards the radiator), and ends in a nipple with about ⅛in. orifice.

Three tests were made: (*a*) With the original pump circulation of the car; (*b*) with the pump replaced by a pipe—*i.e.*, thermo-syphon; and (*c*) the same as *b*, but with the circulator working.

The temperature of the cooling water at the commencement of each test was the same, as all water was emptied and fresh put in before the start. The distance and speed were the same for all tests.

The results were as follows: Temperature of water at end of test—Test A, 56° C.; Test B, 89° C.; Test C, 86° C.

The Vohlanda Fuel (Consumption Test).

Entered by Captain G. Alexander, 4 and 5, Norfolk Street, Strand, London, W.C. Dater of trial: December 2nd, 1912.

Hill Test: The car was timed up the test hill, the speed being 12.49 m.p.h.

How to Ascertain Gear Ratios.

Also Speed in M.P.H. at Certain Engine Revolutions.

A simple method (without taking the gear box and back axle to pieces) of ascertaining the gear ratios of a car is as follows:

Jack up one back wheel and turn it until the valve is in line with some marked spot—a chalk mark on the wing or on the ground. Then engage the top gear, or whatever gear it is of which the ratio is required, and with the compression taps open, or the sparking plugs removed, slowly turn the engine until the jacked-up wheel has made one revolution.

In turning the engine the starting handle should remain engaged the whole time, and careful note taken of the number of turns and the fraction of a turn made to complete a revolution of the wheel. For instance, a mark may be made on the flywheel in line with one on some adjacent fixed point, or the starting handle position carefully noted at the start and finish.

When the number of engine revolutions to one revolution of the jacked-up wheel is known, this number should be multiplied by two to obtain the actual ratio of the gear in use, this being necessitated, of course, by the action of the differential gear. If, for instance, the starting handle and engine have been turned 2¼ revolutions on top gear, the gear ratio is 4½ to 1.

On the lower (indirect) gears the results obtained in this way will show the total reduction between engine and road wheels; that is, including the bevel or worm drive as well as the gear box reduction.

To make the investigation thoroughly, a circular piece of card should be cut about 12in. to 18in. in diameter, and this should be marked at the circumference in tenths of a circle. A hole cut in the centre of the card will allow it to be slipped over the starting handle and centralised in relation to this on the handle-shaft. At the moment before the engine is turned the card should be partially rotated, if necessary, to bring a "starting" mark on the card in line with the handle; then, if the card be prevented from turning while the engine is rotated, the number of revolutions of the engine can be counted, and the fraction seen by the relative positions of the card and the handle when the road wheel has made one revolution.

It is not much use merely knowing that one's gear ratio is, we will say, on top speed "about" 4 to 1. If it be 3.8 to 1 or 4.2 to 1, it will in either case be "about" 4 to 1, but a 3.8 to 1 direct drive is a very much higher gear than 4.2 to 1, and no calculations can be made or results of running compared unless the exact ratio is known.

To Determine Gear Ratios from the Number of Gear Teeth.

First of all, consider two gear wheels in mesh, one with 15 teeth and the other with 45; then their gear ratio is 3 to 1, because the little one will revolve three times while the other revolves once, *i.e.*, $\frac{45}{15} = \frac{3}{1} = 3$. In the case of a car, the ratio required to be known is that between the road wheel and engine, the road wheel being 1.

Suppose the back axle bevels have 66 teeth and 15 teeth respectively, their gear ratio is $\frac{66}{15} = 4.4$ to 1, *i.e.*, the little gear wheel will make 4.4 revolutions to one of the big gear wheel, or, in other words, the propeller-shaft will revolve 4.4 times to one revolution of the road wheel. If the drive be direct to the propeller-shaft, then the engine will revolve 4.4 times to a single revolution of the road wheel. That is to say, the car has a gear ratio of 4.4 to 1 on the direct drive.

If the next gear be put in there will be three gear ratios to consider—(1) the bevels, (2) the constant mesh wheels, and (3) the change wheels.

Assuming for the sake of example that the bevel gears have 15 and 66 teeth respectively, the change wheels 13 (driver) and 27 (driven), and the constant mesh wheels 18 (driver) and 22 (driven) teeth, we know the revolutions of the propeller-shaft in front of the bevel gears are $\frac{66}{15}$ of the road wheel revolutions, so the revolutions of the shaft in front of the next pair of gears will be $\frac{27}{13}$ of the propeller-shaft, or $\frac{27}{13}$ of $\left(\frac{66}{15} \text{ of } \frac{1}{1}\right)$

The revolutions of the shaft in front of the next pair of gears (in this case the engine-shaft) will be $\frac{22}{18}$ of the shaft behind it, or $\frac{22}{18}$ of $\left(\frac{27}{13} \text{ of } \frac{66}{15} \text{ of } \frac{1}{1}\right)$ or $\frac{726}{65}$ or $726 \div 65 = 11.16$.

The gear ratio between the engine and road wheels is therefore 11.16 to 1.

A simpler way of expressing this method of ascertaining the gear ratio is as follows:

$$\overset{\text{bevels}}{\frac{\text{driven}}{\text{driver}}} \times \overset{\text{change wheels}}{\frac{\text{driven}}{\text{driver}}} \times \overset{\text{constant mesh}}{\frac{\text{driven}}{\text{driver}}} = \frac{\text{gear}}{\text{ratio}} \text{ to } 1.$$

To Ascertain M.P.H.

If the gear ratios, diameter of the driving road wheel, and the number of revolutions per minute of the engine be known, the speed of the car may be easily determined by the formula

$$\frac{D'' \times n \times .003}{R} = \text{m.p.h.}$$

Or

$$\frac{D^{\text{mm.}} \times n \times .003}{R \times 25.4} = \text{m.p.h.}$$

In this formula D = diameter of road wheel in inches or millimetres, n = r.p.m. of engine, R = gear ratio. We are indebted to a correspondent, Mr. F. W. Robinson, for this formula.

To Ascertain M.P.H. at 1,000 R.P.M.

Another easily worked formula is that sent us by a correspondent, Mr. W. L. Tod, for easily computing the speed of a car at 1,000 r.p.m. of the engine. Constants are given for different sized tyres; these constants, divided by the gear ratio, give approximately the m.p.h. of the car at 1,000 r.p.m. of the engine.

The following is the formula referred to, in which R = gear ratio.

$$\left.\begin{array}{l}\text{M.P.M. at 1,000}\\ \text{r.p.m. of engine}\end{array}\right\} = \left|\begin{array}{l}83 \div R \text{ for 700-710 mm. wheels}\\ 89 \div R \text{ for 750-760 mm. wheels}\\ 95 \div R \text{ for 810-820 mm. wheels}\\ 104 \div R \text{ for 870-880 mm. wheels}\end{array}\right.$$

For instance, take a car with 820 mm. wheels and 4 to 1 gear. The constant for 820 mm. wheels is 95, and 95 divided by 4 is nearly 24 m.p.h. This is right within a very small approximation, and quite near enough for any rough comparison.

The Importance of Correct Gear Ratios.

How Gear Ratio Affects the "Pushing" Power of an Engine.

MANY small-engined cars are known to accelerate better than some with larger engines, even when the weights are not very different. In such cases this is mainly because the gear ratios are more judiciously chosen. If two cars have to slow down to 5 m.p.h. for a bad corner, it is obvious that the car which has the lower gear can do this without reducing the r.p.m. of its engine to so low a point, and consequently reducing its available horse-power and power of picking up speed quickly to legal limit.

It must be borne in mind that power and engine revolutions go together, so that as the revolutions fall the power goes down. To give its power an engine must make a certain minimum number of revolutions per minute, *i.e.*, it must deliver a certain number of explosions or blows on the piston in a given time. If it run at lower speed it necessarily makes fewer explosions. After all, an engine is only an apparatus for turning explosive mixture into power. Other things being equal, the engine which can usefully explode most explosive mixture in a given time is the one which gives most power. In other words, it is the better converter of gaseous energy (petrol and air) into work; it can "push" the most in a given time. If it be geared too high, the resistance the engine has to overcome is too great for it to be able to "get round" fast—it cannot make enough explosions per minute, and so cannot deliver its power. The power is made up of so many pushes or explosions, and it will take a certain number of explosions to give that total for accelerating a given weight to a given speed, therefore the shorter the time in which that power can be delivered the quicker will be the acceleration of the car. Liveliness of a car is but the quality of good acceleration, and enables a good average speed to be made on twisty roads and in traffic without any temptation to take risks.

To make our meaning more clear, let us take the case of a few representative cars and consider their gear ratios, weights, engine capacities, and any other factors of importance. We can then find out how much gas is available for acceleration purposes, and so compare the power of acceleration in different cars and the time needed to attain a speed of 20 m.p.h.

The appended table has been drawn up by taking the average weights and dimensions of a moderate number of representative cars of various sizes and makes. It will be noted that the cubic capacity of the gas available for each metre travelled rises with the size of the engine, as one would expect; but when the weight of the car and passengers is taken into account, then the cars in Class C (90 × 130 mm.) take first place, and the smallest cars (Class A, 80 × 120 mm.) show an advantage over those in Class B (90 × 120 mm.) And it is this measure of the gas consumed per cwt. for each metre travelled that gives us the means of comparing the powers of acceleration of the various classes. When we consider the engine sizes in relation to the weight we see the larger cars have a greater reserve of power, or, in other words, a greater engine capacity per cwt., but when we take the gearing into account Class C shows an advantage in being lower geared, and Class B, with its smaller engine, has to travel farther for each engine revolution than either Class C or Class D.

Now a poundal is a force which will produce an acceleration of 1ft. per sec. upon a mass of 1 lb. in every second for which it acts. Let us suppose, for the sake of comparison, that every c.c. of gas consumed per cwt. per metre is capable of exerting a force of two poundals (whether this is absolutely correct makes no difference to our argument). From this it is easy to find what the acceleration of each car will be. Class C is first with an acceleration of 1.32ft. per sec. per sec. Class D comes next with 1.25, then Class A 1.24, and finally Class B with 1.18. The speed at the corner may be 5 m.p.h., and we require to increase this pace by 15 m.p.h. (22ft. per sec.) to reach the legal limit. Class C can do this in 16.7s., Class D in 17.6s., Class A in 17.8s., and Class B in 18.8s.

We have not considered the inertia of the moving parts, and this should not make much difference, for the acceleration has to be greater in the smaller and lighter engine. The tractive resistance of the tyres on the road will, however, give the small cars a further advantage, as this is strictly proportional to the weight.

It will be noticed that the cars in Class A have distinctly better acceleration than those in Class B in spite of the engine capacity per cwt. being very much smaller. This is, of course, in consequence of the gear ratios being more suitably chosen.

Lest the purport of this article should be misunderstood it is perhaps as well to point out that it is not intended to be an advocacy of very low gears, but rather of the correct gearing for the individual car. We are very much opposed to very low gearing because it makes the car so irksome to drive along the open road, inasmuch as the engine is tearing round at a very high speed, though the car speed may be very moderate after all. On the other hand, it is better to have a car a shade under-geared rather than somewhat over-geared, as the average speed will be better in the first case than in the second, but the ideal, of course, is the correct gear, neither too low nor too high.

Finally, it should be added we have assumed an equal internal efficiency in the different sizes of engines and cars dealt with in our table. It is obvious that a poor carburetter or an inefficient transmission or any other defect in any one car will affect the result.

AVERAGED PARTICULARS OF VARIOUS CARS.

Class	Size of Engine.	Cubic Capacity.	Engine c.c. per cwt.	Weight, Loaded.	Top Gear Ratio.	Distance travelled for One Engine Rev.	Size of Wheels.	Gas per Metre.	Gas per cwt. per Metre.	Acceleration in feet per sec. per sec.	Time taken to attain 20 m.p.h. from 5 m.p.h.
A.	mm. 80 × 120	2408	84	cwts. 28.5	3.96	mm. 610	mm. 805	c.c. 1970	c.c. 69.1	1.24	secs. 17.8
B.	90 × 120	3052	96	31.8	3.41	730	839	2090	65.7	1.18	18.8
C.	90 × 130	3306	106	31.2	3.57	710	846	2300	73.7	1.32	16.7
D.	100 × 120	3768	104	36.2	3.3	725	820	2540	70.2	1.25	17.6

The Gear Ratios of Modern Cars.

A Tabulated List of the Gear Ratios adopted on 1912 Cars, showing [the Engine Size, Gear Ratio on each Speed, Number of Speeds, and Back Wheel Diameters.

All the cars which appear in the list have the direct drive on top speed, with very few exceptions which are referred to in the footnotes. In many instances two or more alternative gear ratios are given; where only one is given it may be taken as a rule there is an alternative either higher or lower, *i.e.*, for open or closed bodies.

H.P., Name of Car, and Number of Cylinders.	Bore and Stroke.	Gear Ratios. 1st.	2nd.	3rd.	4th.	Rear Wheel Diam.
	mm.					mm.
16-20 Aberdonia (*4*)	89 × 127	15.2	7.1	4	—	820
10 Adler (*4*)	65 × 98	19	13	8	5	750
12 Adler (*4*)	75 × 103	19	13	8	5	810
15 Adler (*4*)	80 × 130	18	10.5	6.5	4	820
20 Adler (*4*)	92 × 148	16	8	5.5	3.5	880
30 Adler (*4*)	105 × 140	13	7.5	4.5	3	880
40 Adler (*4*)	115 × 140	12	7	4.25	2.75	895
10-12 A.G.R. (*4*)	70 × 100	12	7	4	—	750
16 Albion (*2*)	124 × 127	13	6.2	3.75	—	880
15 Albion (*4*)	79 × 127	13.8	7	4.13	—	815
10-12 Alldays (*2*)	95 × 115	14.1	6.8	4.1	3.4	760
12-14 Alldays (*4*)	76 × 120	14.1	6.8	4.1	3.4	760
14-18 Alldays (*4*)	86 × 108	13.9	6.7	4.12	3.44	810
16-20 Alldays (*4*)	86 × 130	12.9	6.3	3.8	3.2	810
25-30 Alldays (*4*)	100 × 130	12.4	5.9	3.6	3	815
30-35 Alldays (*6*)	95 × 115	11.4	5.6	3.37	2.84	880
12 Argyll (*4*)	72 × 120	16.15	9.2	6.24	4.16	760
15 Argyll (*4*)	80 × 120	15.74	9.42	6.31	4.17	815
20 Argyll (*4*)	90 × 140	13	7.6	5	3.5	880
25 Argyll (*4*)	101 × 130	14.2	8.08	5.49	3.67	880
12 Ariel (*4*)	75 × 110	12.15	6.82	3.86	—	750
*15 Ariel (*4*)	85 × 110	13.3	6.52	3.85	3.24	810
20 Ariel (*4*)	90 × 130	12.85	7.05	4.6	3.86	815
25 Ariel (*4*)	100 × 130	12.85	7.05	4.6	3.86	880
15-20 Armstrong-W. (*4*)	80 × 135	15.4	9.2	5.6	3.7	815
17-25 Armstrong-W. (*4*)	85 × 135	15.4	9.2	5.6	3.7	820
22.5 Armstrong-W. (*4*)	95 × 120	12.7	8.7	5.4	3.3	820
25-5 Armstrong-W. (*4*)	100 × 120	12.7	8.7	5.4	3.3	820
30-50 Armstrong-W. (*6*)	90 × 135	11.8	8	5.1	3.3	895
11.9 Arrol-Johnston (*4*)	69 × 120	15.8	9.65	6.53	4.25	760
15.9 Arrol-Johnston (*4*)	80 × 140	14.73	8.95	6	4	815
23.9 Arrol-Johnston (*6*)	80 × 120	13.26	8.07	5.47	3.5	820
*10 Austin (*4*)	76 × 89	16	10.5	6.91	4.76	760
15 Austin (*4*)	89 × 115	11.2	6	4.5	3.5	815
18-24 Austin (*4*)	110 × 127	8.6	5.1	3.7	2.6	820
40 Austin (*4*)	125 × 127	7.7	4.6	3.3	2.4	820
50 Austin (*6*)	110 × 127	7.3	4.4	3.1	2.2	895
16-18 Austro-Daimler (*4*)	80 × 110	15.1	7.75	5.36	3.57	815
16-18 Austro-Daimler (*4*)	80 × 110	15.1	7.75	5.36	3.57	820
16-25 A.-D. Alpine (*4*)	80 × 110	15.1	7.75	5.36	3.57	815
25-30 Austro-Daimler (*4*)	105 × 130	12	6	4	2.86	880
22-80 Prince Henry (*4*)	105 × 165	9.7	4.7	3.13	2.23	820
50-60 A.-D. (*4*), low ...	120 × 157	11.7	5.87	3.81	2.86	895
high ...	120 × 157	9.75	7.86	3.17	2.36	895
15-20 Baguley (*4*)	90 × 130	11.7	6.8	4.6	3.3	815
16 Bell (*4*), high	91 × 120	12.56	6.28	3.14	—	810
low	91 × 120	14.64	7.32	3.66	—	815
20 Bell (*4*), 3 speeds ...	102 × 140	12.56	6.28	3.14	—	820
4 speeds ...	102 × 140	11.96	7.07	4.59	3.14	820
30 Bell (*4*), 3 speeds ...	115 × 150	11	5.50	2.75	—	880
4 speeds ...	115 × 150	10.45	6.18	4.01	2.75	880
10-12 Belsize (*4*)	69 × 130	12.75	6.86	4.58	—	800
14-16 Belsize (*4*)	93 × 120	13	7.25	5.75	4.14	815
18-22 Belsize (*6*)	93 × 120	10.8	6	4.8	3.44	820
16-20 Bentall (*4*)	100 × 95	16.2	7.66	4.15	—	810
16-20 Benz Söhne (*4*) ..	85 × 115	14	8	6	3.75	815
20-30 Benz Söhne (*4*) ..	90 × 140	—	—	—	—	820
12 Berliet (*4*)	70 × 100	13.2	9.6	7	4.25	760
15 Berliet (*4*), light	80 × 120	13.2	9.6	6.4	3.85	810
heavy ...	80 × 120	14.6	10.5	7	4.25	815
curved ..	80 × 120	14.6	10.5	7	4.25	815
20-25 Berliet (*4*)	100 × 140	11	7.9	5.3	3.2	880
long ..	100 × 140	11	7.9	5.3	3.2	880
30-40 Berliet (*4*)	120 × 140	8.8	6.25	4.5	3	880
long ..	120 × 140	8.8	6.25	4.5	3	880
35-45 Berliet (*6*)	100 × 140	8.3	5.85	4.2	2.82	880
12-16 Bianchi (*4*)	75 × 120	—	—	—	3.67	810
16-20 Bianchi (*4*)	90 × 115	10.50	6.50	4.84	3.34	815
20-30 Bianchi (*4*)	110 × 150	10	6.13	4.34	2.67	880

H.P., Name of Car, and Number of Cylinders.	Bore and Stroke.	Gear Ratios 1st.	2nd.	3rd.	4th.	Rear Wheel Diam.
	mm.					mm.
10 Brenna (*4*)	64½ × 100	16.5	9.13	5	—	750
12-14 Brenna (*4*)	70 × 102	14	7	4.5	—	760
12-14 Brenna (*4*)	70 × 102	14	7	4.5	—	760
10 Briton (*2*)	98 × 127	11	6	3.50	—	700
10 Briton (*4*)	68 × 120	13	7	4	—	700
14 Briton (*4*)	80 × 121	11	6	3.50	—	760
*14 Briton (*4*)	80 × 121	8.50	5.75	3.50	2.75	760
B.S.A. (*4*)	75 × 114	15.7	7.46	4.14	—	810
12-20 Buchet (*4*) 4-seater	76 × 120	11.1	5.85	4	—	760
2-seater	76 × 120	9.26	4.88	3.3	—	760
12-20 (*4*) 2-seater torpedo	76 × 120	10.3	5.16	3.53	—	760
10-30 Cadillac (*4*), low	114 × 114	12.5	6.2	3.43	—	880
high	114 × 114	12	6	3.05	—	880
12-15 Calthorpe (*4*)	69 × 125	9.9	6	3.6	—	750
15 Calthorpe (*4*)	80 × 150	9.9	6	3.6	—	810
de luxe	80 × 150	12	7.5	4.6	3.4	815
20 Calthorpe (*4*)	90 × 150	12	7.5	4.6	3.4	820
24 Cameron (*4*)	100 × 94	8	4.50	3.50	—	810
24 Cameron (*4*)	100 × 94	12	5	3.50	—	810
24 Cameron (*6*)	100 × 94	8	4.50	3.50	—	810
36 Cameron (*6*)	100 × 94	12	5	3.50	—	860
10 Charron (*4*)	65 × 120	14.5	7.65	4.5	—	750
12 Charron (*4*)	80 × 120	13.5	7	4	—	815
12 Charron (*4*)	80 × 120	14.73	7.8	5.20	4	815
16 Charron (*4*)	95 × 130	11.7	6.7	4.5	3.4	820
25 Charron (*4*)	110 × 150	10.5	6.7	4.75	3	880
8-9 Chenard-Walcker (*1*)	100 × 120	12	8	5	4	700
10-12 Chenard-W. (*4*) ..	65 × 120	12	8	5	4	750
12-16 Chenard-W. (*4*) ..	75 × 120	11	7	4	3.25	760
12-16 Chenard-W. (*4*) ..	75 × 120	12	8	5	4	815
16-20 Chenard-W. (*4*) ..	80 × 150	10	6.5	4	3	810
16-20 Chenard-W. (*4*) ..	80 × 150	11	7	4	3.25	815
16-20 Chenard-W. (*4*) ..	80 × 150	11	7	4	3.25	820
10-12 Clément (*2*)	102 × 110	17	7.3	4	—	760
14-18 Clément (*4*)	85 × 120	14	8	5.6	4	815
18-28 Clément (*4*)	102 × 110	14	7.1	5	3.7	880
25-35 Clément (4)	107 × 130	14	7.1	5	3.7	880
35-45 Clément (*4*)	115 × 140	10.5	5.5	4	2.6	880
20 Coltman (*4*)	102 × 114	9.9	6.59	4.29	3.06	815
15 Crossley (*4*), short ..	80 × 120	13.4	7.67	5.87	4.08	810
long ..	80 × 120	14	8.01	6.15	4.27	815
light ..	80 × 120	13.4	7.67	5.87	4.08	810
20 Crossley (*4*), short ..	102 × 140	13.6	7.67	5.17	3.41	875
long ..	102 × 140	13.6	7.67	5.17	3.41	880
15 Daimler (*4*)	80 × 130	16.7	7.17	4.38	—	870
20 Daimler (*4*)	90 × 130	16.9	9.3	6.27	4.38	875
25 Daimler (*4*)	101 × 130	15.7	7.75	5.05	3.77	920
38 Daimler (*4*)	124 × 130	13.7	6.8	4.42	3.3	920
23 Daimler (*6*)	80 × 130	16.7	7.17	4.38	—	880
30 Daimler (6)	90 × 130	15.7	7.75	5.05	3.77	920
38 Daimler (*6*)	101 × 130	15.7	7.75	5.05	3.77	935
10 Darracq (*4*)	68 × 120	12.7	7	4.1	—	700
12 Darracq (*4*)	75 × 120	12.7	7	4.1	—	760
14 Darracq (*4*)	80 × 120	12.7	7	4.1	—	810
22 Darracq (*4*)	100 × 140	10	6	4.5	3	815
20 Darracq (*4*), valveless	95 × 140	12	7	5	3.5	—
12 Deasy (*4*)	75 × 110	17.5	8.38	5.83	4.38	810
14-20 Deasy (*4*), high ..	80 × 130	15	9.43	5.66	3.77	815
low ..	80 × 130	17.53	10.95	6.57	4.38	815
18-24 S.K. Deasy (*4*),high	90 × 130	13.2	8.25	4.95	3.3	820
low	90 × 130	15	9.43	5.66	3.77	820
24-30 S.K. Deasy (*6*),high	90 × 130	13.2	8.25	4.95	3.3	895
low	90 × 130	15	9.43	5.66	3.77	895
6 De Dion Bouton (*1*)	84 × 130	17.16	8.07	4.84	—	700
7 De Dion Bouton (*2*)	66 × 120	17.16	8.07	4.84	—	700
9 De Dion Bouton (*2*)	75 × 130	16.46	8.71	5.23	—	750
	75 × 130	15.29	8.09	4.85	—	750
12 De Dion Bouton (*4*)	66 × 120	14.27	7.55	4.53	—	760
	66 × 130	13.37	7.08	4.25	—	760

*15 h.p. Ariel has direct drive on third speed. *14 h.p. Briton four-speed model has direct drive on third speed

*The 10 h.p Austin has six options of gears.

A Tabulated List of Gear Ratios. *(Continued.)*

H.P., Name of Car, and Number of Cylinders.	Bore and Stroke.	Gear Ratios. 1st.	2nd.	3rd.	4th.	Rear Wheel Diam.
	mm.					mm.
14 De Dion Bouton (4)	70 × 130	13.85	7.33	4.40	—	810
	70 × 130	12.59	6.66	4	—	810
18 De Dion Bouton (4)	80 × 140	18.27	11.16	7.47	4.44	875
	80 × 140	16.61	10.15	6.79	4	875
25 De Dion Bouton (4)	100 × 140	19.40	9.37	5.99	3.33	880
	100 × 140	18.26	8.79	5.62	3.12	880
26 De Dion Bouton (8)	70 × 130	15.42	9.42	6.31	3.71	880
	70 × 130	13.84	8.46	5.66	3.33	880
50 De Dion Bouton (8)	94 × 140	16.28	8.27	5.29	2.94	935
10 Delage (4)	62 × 110	12.14	7.17	4.26	—	710
12 Delage (4), high	65 × 110	12.14	7.17	4.26	—	760
low	65 × 110	12.80	7.58	4.50	—	760
14 Delage (4), high	75 × 120	11	6.51	3.87	—	765
low	75 × 120	11.56	6.82	4.06	—	765
15.9 Delage (4)	66 × 125	10.40	6.15	3.66	—	815
8-10 Delahaye (2)	80 × 120	18	10	5	—	760
9-11 Delahaye (4)	62 × 100	18	10	5	—	760
12-16 Delahaye (4)	75 × 110	17.1	10	5	—	815
long	75 × 110	17.1	10	6	4.5	815
16-20 Delahaye (4)	85 × 130	15.5	8	5	4	880
long	85 × 130	15.5	8	5	4	880
20-30 Delahaye (4)	95 × 130	15.8	8	4.8	3.3	880
long	95 × 130	15.8	8	4.8	3.3	880
18-24 Delahaye (6)	75 × 120	15.5	8	5	4	880
long	75 × 120	15.5	8	5	4	880
17 Delaunay-Belleville (4)	85 × 130	14.6	9.3	5.9	3.86	815
24.6 Delaunay-Bellev. (4)	100 × 140	12.7	8.1	5.1	3.37	880
19 Delaunay-Belleville (6)	72 × 120	15.6	10	6.3	4.14	815
26 Delaunay-Belleville (6)	85 × 130	13.7	8.75	5.5	3.64	880
37 Delaunay-Belleville (6)	100 × 140	11.8	7.6	4.75	3.13	920
18 Dennis (4), colonial	90 × 110	22.5	11.5	7.8	5.1	1010
20 Dennis (4), low	90 × 130	13.6	9.2	5.8	4	815
high	90 × 130	10.2	6.8	4.4	3	815
24 Dennis (4), low	100 × 130	11.9	8	5	3.5	880
high	100 × 130	10.2	6.8	4.4	3	880
10-12 D.F.P. (4)	65 × 120	13.25	7.29	4.28	—	750
12-15 D.F.P. (4)	70 × 130	10.25	6.79	5.10	3.93	760
16-22 D.F.P. (4)	80 × 140	—	—	—	—	815
15 Dodson (2), valveless	112 × 127	13.6	8.8	5.8	3.8	815
25 Dodson (2), valveless	133 × 140	10	6.2	3.2	—	820
12-16 Dodson (4)	80 × 120	15.1	7.8	4.5	—	810
20-30 Dodson (4)	100 × 140	12	6.5	4.4	3	880
20-25 E.M.F.	102 × 115	11	6.5	3.25	—	810
*10 Enfield (2)	95 × 114	14.1	6.8	4.1	3.4	760
*12 Enfield (4)	76 × 120	14.1	6.8	4.1	3.4	760
*14-16 Enfield (4)	86 × 108	13.9	6.7	4.1	3.4	810
*16-20 Enfield (4)	86 × 130	12.9	6.3	3.8	3.2	810
*20 Enfield (4)	100 × 115	12.8	6.25	3.7	3.1	815
12-14 F.I.A.T. (4)	70 × 120	17.64	11.76	7.58	4.92	810
15 F.I.A.T. (4), light	80 × 130	14.6	9.74	6.27	4.07	815
20-30 F.I.A.T. (4)	95 × 140	12.63	8.12	5.47	3.5	820
35-50 F.I.A.T. (4)	110 × 150	11.06	7.11	4.79	3.06	880
20-30 F.I.A.T. (6)	80 × 130	12.63	8.12	5.47	3.5	820
15-9 F.L. (4)	80 × 100	13.5	8.25	5.25	4	810
18-24 F.L. (6)	80 × 100	13.5	8.25	5.25	4	815
15-20 Flanders (4)	92 × 96	11	6.5	3.75	—	760
20 Ford (4)	95 × 102	8	3.64	—	—	760
G.N. (4)	90 × 130	14.66	7.9	5.7	3.5	815
15 Gobron (4)	75 × 150	14.4	8.7	5.8	3.8	815
20-30 Gobron (4)	90 × 180	6.9	5.6	4.7	3.06	880
40-50 Gobron (4)	110 × 250	5.9	3.8	3.07	2.48	935
8 G.W.K. (2)	86 × 92	10	6.7	4.7	3.6	650
12-15 Hillman (4),	89 × 110	11.85	6.89	4.06	—	760
25 Hillman (4)	127 × 127	7.85	3.92	2.5	—	820
10-12 Hobson (4)	70 × 130	18	9	5	—	810
14-20 Hobson (4)	90 × 120	17	8	4	—	815
20-30 Hobson (4)	106 × 130	15	8	4.7	3	880
12-16 Hotchkiss (4)	80 × 120	17.2	9.5	6.3	4.2	815
	80 × 120	16	8.8	6	3.9	815
18-22 Hotchkiss (4)	95 × 130	14	7.7	5	3.4	880
20-30 Hotchkiss (4)	110 × 150	13	7.2	4.8	3.2	895
	110 × 150	12	6.6	4.4	2.9	895
20-30 Hotchkiss (6)	95 × 110	12	6.6	4.4	2.9	880
	95 × 110	11	6	4.1	2.7	880
25-35 Hotchkiss (6)	95 × 130	12	6.6	4.4	2.9	895
	95 × 130	11	6	4.1	2.7	895
25 Hudson (4)	102 × 114	7.5	6	3.5	—	815
5½ Humber (2)	68 × 100	12	5	—	—	660
11 Humber (4), 2-seater	68 × 120	14.3	7.8	4	—	800
4-seater	68 × 120	15.3	8.3	4.33	—	800
14 Humber (4), 2-seater	78 × 110	13.6	7.4	3.87	—	810
4-seater	78 × 110	14.6	8.	4.14	—	810
12-20 Humber (4)	90 × 100	14.96	9.48	6.46	4	810
20 Humber (4), high	90 × 120	13.8	8.9	6.12	3.87	815
low	90 × 120	14.8	9.5	6.55	4.14	820
28 Humber (4), high	105 × 140	12	6.5	4	3	815
low	105 × 140	13.5	7.3	4.56	3.37	820
12-14 Hupmobile (4) 2-sr.	83 × 88	10.8	4	—	—	800
4-seater	83 × 88	12.96	4.8	—	—	800
15-18 Hupmobile (4)	83 × 140	13	6.5	3.6	—	810
10 Hurtu (4)	70 × 100	11.25	6.3	4	—	700
10 Imperia (4)	65 × 110	15	7.7	4.3	—	710
12 Imperia (4)	75 × 100	14	7.5	4	—	760
15.9 Imperia (4)	80 × 120	12	6	3.5	—	815
20 Imperia (4)	90 × 130	15	7.4	4.75	3.2	815
26 Imperia (4)	100 × 150	15	7.4	4.75	3.2	880
15 Iris (4)	80 × 114	13.9	7.25	4.07	—	815
25 Iris (4)	108 × 133	9.72	5.33	2.92	—	880
35 Iris (4)	127 × 133	8.2	4.5	2.46	—	880
14-18 Itala (4)	77 × 120	17.3	13.54	7.35	4.88	810
18-24 Itala (4)	90 × 130	13.75	10.77	5.85	3.88	815
25 Itala (4), valveless	90 × 130	13.75	10.77	5.85	3.88	820
25-35 Itala (4)	115 × 130	9.05	5.71	3.95	2.77	880
35-45 Itala (4)	127 × 140	7.45	4.70	3.14	2.28	895
60-70 Itala (4)	127 × 160	7.45	4.70	3.14	2.28	895
35 Itala (4), valveless	105 × 150	7.45	4.70	3.14	2.28	880
50-65 Itala (4)	140 × 150	6.96	4.38	3.06	2.13	895
16-20 Krit (4)	94 × 102	13.25	7.5	4.5	—	810
12 La Buire (4)	70 × 150	15.2	9.7	5.6	3.8	810
15 La Buire (4)	80 × 160	14	8.9	5.2	3.5	815
20 La Buire (4)	90 × 160	13.2	8.6	4.8	3.3	875
24 La Buire (4)	105 × 150	12	7.6	4.5	3	880
24 La Buire (6)	85 × 140	12	7.6	4.5	3	880
20 Lagonda (4)	90 × 120	9.5	5.5	3.5	—	810
30 Lagonda (6)	90 × 120	8.1	4.7	3	—	875
25 Lanchester (4)	102 × 102	13	7.75	4.38	—	880
38 Lanchester (6)	102 × 102	12	6.75	3.38	—	895
*15 Lancia (4)	80 × 130	—	—	4.78	3.58	815
24-40 Lancia (4), high	100 × 130	12.27	7.45	5.07	3.06	820
low	100 × 130	13.08	7.94	5.4	3.26	820
Le Gui (4)	65 × 130	10.50	8.38	5	4	750
Le Gui (4)	75 × 120	10	7.88	4.50	3.50	760
12-14 Licorne (4)	75 × 120	13	6.5	4	—	800
15.9 Martini (4)	80 × 120	13.78	9.16	6.03	3.86	810
16-24 Martini (4)	90 × 140	11.28	7.52	4.93	3.16	815
10-12 Mass (4)	75 × 120	9	5.25	3.5	—	750
15 Mass (4)	90 × 150	10	5	3.33	—	815
20 Mass (4)	110 × 130	10	5	3.33	—	880
17 Maudslay (4)	90 × 130	11.6	7.5	4.8	3.1	875
17 Maudslay (4)	90 × 130	11.6	7.5	4.8	3.1	880
30 Maudslay (6)	90 × 130	9.4	6.1	3.9	2.5	880
*14 Maxwell (2)	100 × 100	13.50	4.50	—	—	750
25 Maxwell (4)	100 × 100	12.75	6	3.88	—	810
15 Mercédès (4)	70 × 120	20	11.6	7	4.8	810
20 Mercédès (4)	80 × 130	17.3	10.1	5.8	4.06	820
30 Mercédès (4)	90 × 140	14.3	7.5	4.8	3.3	820
40 Mercédès (4)	110 × 148	12.8	6.8	4.3	3	895
40 S.K. Mercédès (4)	100 × 130	11.4	6.3	4	3	820
*50 Mercédès (4)	120 × 160	9.1	5	3.2	2.4	935
16 Minerva (4)	80 × 125	11.4	6.7	4.7	3.5	815
26 Minerva (4)	100 × 140	9.9	5.8	4.1	3.1	880
38 Minerva (4)	124 × 150	7.8	4.6	3.2	2.4	880
10-14 M.S.L. (4)	70 × 120	8.3	6.2	3.6	—	760
12-16 M.S.L. (4)	75 × 120	8.3	6.2	3.6	—	810
15 Napier (4)	82 × 127	16.6	7.27	4	—	815
30 Napier (6)	82 × 127	15.1	6.7	3.8	—	880
30 N.E.C. (4)	114 × 114	15.5	7.9	5	3.88	920
40 N.E.C. (4)	127 × 114	15.5	7.9	5	3.88	920
16-18 New Pick (4), high	95 × 127	9	6	3	—	800
low	95 × 127	12	8	4	—	800
10 N.S.U. (2)	75 × 125	21.90	11	5.62	—	750
10-12 N.S.U. (4)	70 × 78	20	10.50	3	—	700
14 N.S.U. (4)	75 × 88	19.50	9.75	5.09	—	760
18 N.S.U. (4)	80 × 104	22.80	11.10	6.70	4.70	810

*Enfields have direct drive on third gear. *15 h.p. Lancia has direct drive on both third and fourth speeds.

*14 h.p. Maxwell has epicyclic gear and direct drive. *50 h.p., 70 h.p., and 90 h.p. chain-drive Mercédès geared to requirements.

A Tabulated List of Gear Ratios. *(Continued.)*

H.P., Name of Car, and Number of Cylinders.	Bore and Stroke.	Gear Ratios. 1st.	2nd.	3rd.	4th.	Rear Wheel Diam.
	mm.					mm.
20 N.S.U. (4)	85 × 115	21	10.20	6.10	4.29	815
24 N.S.U. (4)	97 × 115	18.30	8.90	5.35	3.75	820
10 Opel (4)	65 × 95	19	9.5	6.75	4.75	700
12 Opel (4)	70 × 100	19	9.5	6.75	4.75	760
13.9 Opel (4)	75 × 115	18.5	8.1	6.5	4.5	810
15.8 Opel (4)	80 × 130	12.5	6.8	4.5	3.75	815
25 Opel (4)	100 × 130	11	6.5	4.5	3.4	880
32.8 Opel (4)	115 × 150	11	6.5	[illegible]	3	895
42 Opel (4)	130 × 165	11	6.5	4	3	895
12-14 Oryx (4)	70 × 102	16.38	8.50	4.75	—	760
18-24 Oryx (4)	85 × 115	18.75	9.63	6.75	4.25	815
15-20 Overland (4)	89 × 114	9.5	4	—	—	810
20-25 Overland (4)	102 × 114	9	5	3.5	—	810
25-30 Overland (4)	105 × 114	9	5	3.5	—	810
30-35 Overland (4)	111 × 114	9	5	3.5	—	860
10-14 Palladium (4)	65 × 130	12	7.5	4.25	—	750
12-16 Palladium (4)	75 × 120	11.5	5.5	3.73	—	760
15-18 Palladium (4)	75 × 150	11.5	5.5	3.73	—	810
25 Panhard (4)	100 × 140	—	—	—	3.36	880
12 Peugeot (2), Lion	75 × 150	7	4.50	2.50	—	700
16 Peugeot (2), Lion	85 × 150	7	4.50	2.50	—	700
10-14 Peugeot (4)	70 × 130	17.50	10.50	6.50	4.50	810
12-15 Peugeot (4)	80 × 130	15	9	5.50	4	815
16-20 Peugeot (4)	90 × 150	15	8.50	5	3.50	880
17-22 Peugeot (4)	92 × 150	15	9	5.50	4	820
22-30 Peugeot (4)	100 × 160	12	7	4	3	880
35-45 Peugeot (4)	110 × 160	12	7	4	3	880
18-24 Peugeot (6)	80 × 110	15	9	5.50	4	880
8 Phanomobile (2)	82 × 84	10	5	—	—	700
10 Phanomobile (2)	82 × 110	10	5	—	—	700
12 Phanomobile (4)	74 × 90	10	5	—	—	700
8-10 Phœnix (2)	90 × 100	11.7	7	4.2	—	700
12-15 Phœnix (2)	102 × 115	11	6.6	4	—	760
10-12 Pilain (4)	65 × 120	15.7	9.5	6.5	4.4	750
12-15 Pilain (4)	75 × 110	14.3	8.6	6.5	4	810
16-20 Pilain (4)	90 × 120	12.3	7.6	5.4	3.7	810
16-20 Pilain (4), light	90 × 120	11.8	7.1	5.3	3.3	810
20-30 Pilain (4)	100 × 140	10.3	6.4	4.6	3.1	820
28-40 Pilain (4)	124 × 140	11	6.1	3.4	2.4	880
15-18 Pilain (6)	65 × 120	13.2	8	6	3.7	815
*Pilot (1)	90 × 105	12	4	—		700
*Pilot (1)	94 × 120	12	4	—		700
*Pilot (4)	65 × 110	12	4	—		700
8 Renault (2), high	75 × 120	—	—	3.5	—	700
low	75 × 120	—	—	4.66	—	700
9 Renault (2), high	80 × 120	—	—	3.5	—	800
low	80 × 120	—	—	6.66	—	800
10 Renault (4), high	70 × 110	13.1	6.8	3.55	—	800
low	70 × 110	26.3	11.8	6.15	—	810
12 Renault (4), high	80 × 120	6.9	6.1	3.20	—	810
low	80 × 120	10.7	9.3	4.92	—	815
14 Renault (4), high	90 × 140	11	5.9	4.6	2.8	880
low	90 × 140	17.7	9.4	7.4	4.5	880
20 Renault (4), high	100 × 160	8.9	4.7	3.43	2.22	880
low	100 × 160	11.3	7.45	5.54	3.58	895
35 Renault (4), high	130 × 160	7.4	3.9	2.9	1.88	920
low	130 × 160	11.1	5.8	4.3	2.83	920
18 Renault (6), high	80 × 140	11	5.9	4.6	2.8	880
low	80 × 140	16.4	8.7	6.8	4.16	880
40 Renault (6), high	100 × 160	8.6	4.3	3.1	2.15	935
low	100 × 160	12.28	6.2	4.4	3.08	935
18-20 R.M.C. (4)	95 × 114	11.55	5.65	3.5	—	810
25-30 R.M.C. (4)	108 × 114	9.35	5.25	3.5	—	860
40-50 Rolls-Royce (6)	113 × 119	8.3	4.9	2.9	—	895
15 Rothwell (4)	79 × 127	14.5	7.1	3.6	—	815
20 Rothwell (4)	102 × 127	12.1	6.2	2.95	—	815
20 Rothwell (4)	102 × 127	9.8	5	2.95	—	880
6 Rover (1)	97 × 110	16	9	5	—	700
8 Rover (1)	114 × 130	13.3	7.4	4.1	—	750
8 Rover-Knight (1)	102 × 130	17.4	9.6	5.3	—	750
12 Rover-Knight (2)	96 × 130	14.6	8.1	4.5	—	810
12 Rover (4)	75 × 130	17.7	8.4	4.4	—	810
18 Rover (4)	90 × 130	16	8.3	5.3	4	820
landaulet	90 × 130	17.5	9.14	5.83	4.37	880
10 S.C.A.R. (2)	90 × 100	14	12	8.50	4.50	710
11.8 S.C.A.R. (4)	69 × 140	13	11	8	4	760
15.9 S.C.A.R. (4)	80 × 140	12	10	7	3.75	815
15 S.C.A.T. (4)	85 × 120	12	7.3	4.5	3.06	815
22 S.C.A.T. (4)	102 × 140	9	6	3.7	2.8	880
25 Sheffield-Simplex (6)	89 × 127	12.6	6.6	3.75	—	880
45 Sheffield-Simplex (6)	114 × 114	10	5.28	3	—	895
45 Sheffield-Simplex (6)	114 × 114	11.2	5.87	3.33	—	895
45 Sheffield-Simplex (6)	114 × 114	6.8	3.33	—	—	895
15 Singer (4)	80 × 130	15	8.3	5.65	4	815
20 Singer (4)	90 × 130	15	8.3	5.65	4	815
20 Singer (4)	90 × 130	16	8.8	6	4.25	820
12 Sizaire-Naudin (1)	120 × 140	10.75	8.44	5.82	—	750
12 Sizaire-Naudin (4)	70 × 140	10	5	3.5	—	760
15 Sizaire-Naudin (4)	70 × 170	10	5	3.5	—	810
12-15 S.P.A. (4)	70 × 120	15.05	10.04	6.69	4.46	810
16-20 S.P.A. (4)	85 × 120	12.15	8.1	5.4	3.6	815
25-30 S.P.A. (4), low	100 × 140	9	6.08	4.05	2.7	815
high	100 × 140	8.80	5.87	3.91	2.61	820
40-50 S.P.A. (4)	130 × 145	7.56	5.04	3.36	2.24	880
30-40 S.P.A. (6)	95 × 120	12.24	8.16	5.44	3.63	820
60-70 S.P.A. (6)	130 × 145	7.56	5.04	3.36	2.24	880
12 Springuel (4)	75 × 120	10	7.2	5.3	4	760
16 20 Springuel (4)	90 × 120	8.4	5.7	4.3	3.2	815
28-35 Springuel (4)	106 × 130	12	6.2	4.3	3	880
12 Spyker (4)	72 × 110	14.3	7.8	4.8	—	760
18 Spyker (4)	90 × 110	15.8	12.4	5.7	3.8	815
20 Spyker (4)	90 × 135	15.8	12.7	5.7	3.8	815
25 Spyker (4)	106 × 130	11.9	7.5	4.7	3.3	880
40 Spyker (4), high	120 × 160	8.9	5.8	3.7	2.47	880
low	120 × 160	10	6.6	4.2	2.8	880
25-30 Spyker (6)	90 × 110	10.7	6.37	3.6	—	880
15 Standard (4)	79 × 120	15	8.4	4.5	—	810
20 Standard (6)	79 × 120	13.4	7.5	4	—	820
25 Standard (6)	89 × 108	15.5	7.3	4	—	880
10 Star (4)	68 × 120	14	7	4.3	—	810
12 Star (4)	80 × 120	13.6	8.1	4.9	3.57	810
15 Star (4)	90 × 120	12.8	7.6	4.6	3.3	810
20 Star (4)	102 × 127	12.6	6.15	3.38	2.88	875
25 Star (4)	108 × 127	12.6	6.15	3.38	2.88	880
20 Star (6)	80 × 120	14.4	8.5	5.2	3.8	—
20.1 Stella (4)	90 × 120	12	7	3.25	—	815
25 Stoddard (4)	102 × 115	11	6	4	—	810
10-16 Stoewer (4)	65 × 118	24	11	7	4.25	750
10-16 Stoewer (4)	75 × 88	24	10	4.25	—	750
15-22 Stoewer (4)	78 × 118	21	9.5	6	3.5	810
25 S.K. Stoewer (4)	101 × 130	—	—	—	—	880
30 S.K. Stoewer (4)	110 × 130	—	—	—	-	880
*15 Straker-S. (4), landau.	87 × 120	12.92	6.45	4.25	—	810
4-seater	87 × 120	11.92	5.97	3.93	—	810
2-seater	87 × 120	10.98	5.49	3.61	—	810
runabout	87 × 120	10.4	5.2	3.42	—	810
12-16 Sunbeam (4)	80 × 150	11.95	7.84	5.31	3.6	815
	80 × 150	11.4	7.4	5.06	3.4	815
16-20 Sunbeam (4)	90 × 160	11.6	6.6	4.9	3.3	820
	90 × 160	12.4	7.03	5.2	3.59	820
25-30 Sunbeam (6)	90 × 160	10.03	5.6	4.2	2.9	880
	90 × 160	11.6	6.6	4.9	3.3	880
7 Swift (1)	105 × 127	13	6.5	3.81	—	700
8 Swift (2)	85 × 120	13	6.5	3.81	—	700
10-12 Swift (2)	102 × 110	20.5	8.7	4.8	—	750
10-12 Swift (4)	68 × 110	17	9.9	6.6	4.8	760
15 Swift (4)	85 × 120	14	8.15	5.43	3.94	815
landaulet	85 × 120	14.8	8.65	5.77	4.18	815
12 Talbot (4)	80 × 120	14.6	9	6	4	815
15 Talbot (4)	90 × 140	12.8	7.3	4.7	3.4	815
25 Talbot (4)	102 × 140	11.3	6.5	4.2	3.05	820
20 Talbot (6)	80 × 120	13.6	7.75	5	3.6	820
18 Thornycroft (4)	101 × 114	13.1	6.84	3.78	—	815
Colonial	101 × 114	13.1	6.84	3.78	—	920
9 Turner Petrol (2)	90 × 90	10.5	5	—	—	650
10 Turner Petrol (4)	60 × 100	14.5	5	—	—	750
	60 × 100	17.5	10	5	—	750
15 Turner Petrol (4)	75 × 120	12	7	4.25	—	815
20 Vauxhall (4)	90 × 120	13.4	8.5	5.6	3.65	875
landaulet	90 × 120	14.1	8.9	5.9	3.85	875
30 Vauxhall (6)	90 × 120	12.1	7.7	5.05	3.3	880
landaulet	90 × 120	13.4	8.5	5.6	3.65	880
12-16 Vermorel (4)	74 × 120	14.4	8	5.8	4	760
	74 × 120	14.4	8	5.8	4	760

*Pilot cars have friction drive. *15 h.p. Straker-Squire landaulet has worm-driven axle; the open cars are bevel driven.

A Tabulated List of Gear Ratios. *(Continued.)*

H.P., Name of Car, and Number of Cylinders.	Bore and Stroke.	Gear Ratios. 1st	2nd	3rd	4th	Rear Wheel Diam.
	mm.					mm.
18-22 Vermorel (4)	90×130	12.5	7	4.6	3.3	815
Vulcan (4)	80×120	12.88	7.05	3.88	—	760
Vulcan (4)	89×120	15.5	9.95	6	3.88	815
Vulcan (6)	89×120	15.5	9.95	6	3.88	875
Waverley (4)	65×110	10	6	4	—	750
*20-30 White (4)	95×130	12.64	5.85	3.6	2.83	875
*40 Winton (6)	114×127	9.58	4.68	3.2	2.55	915
20 Withers (4)	90×130	15.50	8.25	4.75	4	815
de luxe	90×130	15.50	8.25	4.75	4	820
25 Withers (4)	100×130	14.50	6.50	4.50	3.50	880
30 Withers (4)	110×130	13	6	4	3	880
35-40 Withers (4)	120×130	13	6	4	3	895
de luxe	120×130	9.50	5.50	3.75	3	895
12-16 Wolseley (4)	79×121	14.82	7.43	4.44	—	810
16-20 Wolseley (4)	90×121	16.5	8.29	5.55	4.25	815
	90×121	16.5	8.29	5.55	4.38	820
20-28 Wolseley (4)	102×130	12.87	7.88	5.42	3.61	820
	102×130	12.87	7.88	5.42	3.83	880
35-40 Wolseley (4)	121×130	12.87	7.88	5.42	3.61	895
24-30 Wolseley (6)	90×130	12.87	7.88	5.42	3.61	895

*White petrol car has direct drive on third speed.

H.P., Name of Car, and Number of Cylinders.	Bore and Stroke.	Gear Ratios. 1st	2nd	3rd	4th	Rear Wheel Diam.
	mm.					mm.
50 Wolseley (6)	114×146	10.72	6.67	4.97	3.44	935
6 Zebra (1)	88×102	11	5	—	—	700
14 Zedel (4)	72×120	14	7.8	5.76	3.6	710
25-30 Zedel (4)	90×140	12.6	7.64	5.6	3.5	820

Steam and Electric Cars.

H.P., Name of Car, and Number of Cylinders.	Bore and Stroke.	1st	2nd	3rd	4th	Rear Wheel Diam.
8 Pearson-Cox (3)	54×57	3.75	—	—	—	750
15 Pearson-Cox (3)	61×77	3.50	—	—	—	810
Rutherford (3), steam	89×114	3	—	—	—	815
10 Stanley (2)	82×108	1.4	—	—	—	800
	82×108	1.4	—	—	—	810
20 Stanley (2)	102×127	1.25	—	—	—	915
10 Turner Steam (3)	34×80	4.75	—	—	—	810
12 Turner Steam (3)	50×80	4.75	—	—	—	810
15 Turner Steam (3)	53×80	4 75	—	—	—	815
20 Turner Steam (3)	62×89	4.75	—	—	—	820
15 White (2)	64×108	3	—	—	—	815
40 White (2)	76×140	3	—	—	—	920
8 Electromobile	—	—	—	—	—	815

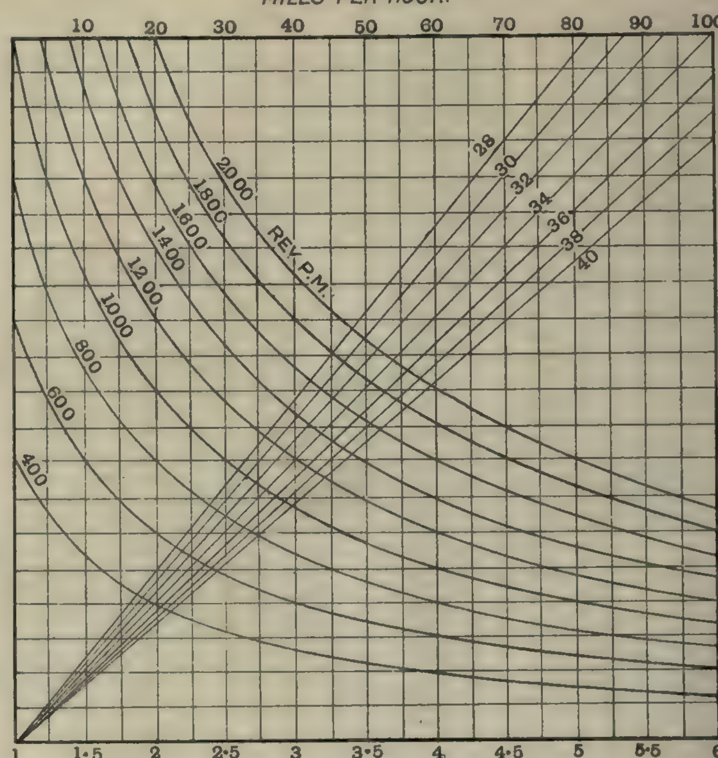
* 40 h.p. Winton has direct drive on third speed.

Engine R.P.M. at Various Road Speeds.

The accompanying diagram has been designed by Mr. J. Dalrymple Bell, with the object of facilitating to the last degree of simplicity, the work of ascertaining the number of engine revolutions per minute at various road speeds. It is only necessary to know the road speed, wheel diameter, and gear ratio, and then the engine speed can be ascertained. For instance, a motorist may desire to know the speed of his engine in revolutions per minute when his car is travelling at a certain speed in miles per hour. By the usual method of obtaining this information a considerable amount of calculation would be required, but with the diagram herewith the most unskilled in mathematics can surpass in point of time the most facile slide rule operator in obtaining the desired result. To find on the accompanying curve the number of revolutions per minute that the engine is making at any speed, find the miles per hour on the top line and follow the vertical line down until it cuts the wheel diameter line. Then move along a horizontal line until a point vertically above the gear ratio on the bottom line is arrived at. The engine revolution curve which passes through this point, or would pass through it if drawn up, gives the required engine speed.

For instance, a car is proceeding at thirty miles per hour; it has 32in. wheels and a 3 to 1 gear ratio. What is the engine speed? Proceed along the top line till we strike fig. 30; drop vertically till the 32in. wheel line is reached. Then work horizontally till the vertical line is met from the gear ratio number 3 on the base line. The nearest engine revolution curve will show that the engine speed is nearly 1,000 revolutions per minute.

If any three of the four quantities—gear ratio, speed of car, wheel diameter, and engine speed—are known, the fourth one can be found by inspection. Engine speed in revolutions per minute is, however, the factor usually required; we have therefore taken that for our example. The following is a conversion table for wheel diameters, which may prove useful in connection with this chart:



A CURVE DESIGNED BY MR. J. DALRYMPLE BELL, FROM WHICH, WHEN THE DETAILS OF ANY THREE ARE KNOWN, EITHER THE ENGINE SPEED, SPEED OF THE CAR IN M.P.H., WHEEL DIAMETER, OR GEAR RATIO, MAY BE OBTAINED.

Mm. In.	Mm. In.	Mm. in.	Mm. In.	Mm. In.
650=25.6	760=30	820=32.3	880=34.6	965=38
700=27.5	800=31.5	863=34	895=35.25	1018=40
710=28	810=32	870=34.25	920=36.2	
750=29.5	815=32.2	875=34.5	935=36.8	

Motor Associations, Societies, and Clubs.

(Home and Colonial.)

Particulars of the Objects, Conditions of Membership, Headquarters, etc., of the various Automobile Bodies.

Section I.—Home.

The National Automobile Council.

(Inaugurated December, 1911.)

SECRETARY: Mr. J. W. Orde, 90, Pall Mall, London, S.W.

The following bodies are represented on the N.A.C.:

The Auto-Cycle Union.
The Commercial Motor Users' Association.
The Institute of British Carriage Manufacturers.
The Institution of Automobile Engineers.
The London Motor Cab Proprietors' Association.
The London Omnibus Owners' Federation.
The Royal Automobile Club and Associated Clubs.
The Scottish Automobile Club.
The Irish Automobile Club.

The National Automobile Council was not hastily formed by any means. For some time previous it had been felt that if the interests of the movement were to receive due recognition at the hands of the authorities it was necessary that means should be found by which the numerous bodies representative of the various aspects of automobilism should be able to meet and consult, with a view of taking united action in matters of first importance. The Royal Automobile Club took the initial steps in June of 1911.

The draft scheme provided that the functions of the Council should be mainly deliberative, and that no interest or organisation should be bound by the majority, but that where it was found possible, as the result of the deliberations of the Council, to arrive at a unanimous decision in regard to any matter of legislation or taxation, the views of the Council should be put forward in its name as representing the views of the automobile movement as a whole.

The following are the objects of the Council:

(a) That the Council should consider matters of legislation and taxation.

(b) That the findings of the Council be submitted to the constituent bodies for their consideration, and in all cases where unanimity is reached the decisions of the Council shall be put forward in the manner provided in clause *(e)*.

(c) That each of the constituent bodies, as the meetings of the Council may be irregular in date and may be called to meet an emergency, should nominate a panel of at least twelve delegates, and from among those best qualified, having regard to the subject to be discussed, each body could select three delegates for any particular meeting of the Council. Each delegate should represent one body only at any one meeting of the Council.

(d) That the Council shall choose at its first meeting in each year its own chairman for the year, who may be chosen from outside any of the panels.

(e) That the Royal Automobile Club should place its committee room at the disposal of the Council, convene all meetings when required by any one of the constituent bodies, provided that the chairman of the Council is of opinion that the subject proposed for discussion comes within the terms of reference, and give effect in the name of the Council to the decisions of the Council by placing its organisation at the disposal of the Council for all purposes of executive action.

The one thing which detracts from the value and possibilities of the N.A.C. is the fact that the Automobile Association and Motor Union has refused to join, on the grounds that the system of representation on the Council is not fair. Under existing conditions, the A.A. and M.U., representing between 20,000 and 30,000 motorists, would have no more delegates on the N.A.C. than the Commercial Motor Users' Association, which numbers approximately 300.

Royal Automobile Club.

MEMBERS' HEADQUARTERS: Pall Mall, London, S.W.

ASSOCIATES' HEADQUARTERS: Pall Mall, London, S.W. (Western Entrance).

PATRON: His Majesty the King.

PRESIDENT: H.R.H. the Duke of Connaught, K.G.

VICE-PRESIDENTS: The Earl of Derby, G.C.V.O., C.B.; the Earl of Dudley, G.C.M.G., G.C.V.O.; Lord Montagu of Beaulieu; Sir David L. Salomons, Bart.; Col. Mark Mayhew; Sir Charles D. Rose, Bart., M.P.; Mr. Alfred F. Bird, M.P.; and Mr. Roger W. Wallace, K.C.

CHAIRMAN: The Hon. Arthur Stanley, M.V.O., M.P.

VICE-CHAIRMEN: Mr. A. Armitage, Dr. Dugald Clerk, F.R.S., and Col. Sir D. A. Kinloch, Bart., C.B., M.V.O.

MEMBERS OF ALL COMMITTEES: Sir Charles D. Rose, Bart., M.P., and Col. H. C. L. Holden, C.B., F.R.S.

HON. TREASURER: Mr. Paris E. Singer.

HON. CONSULTING ENGINEER: Mr. W. Worby Beaumont, M.Inst.C.E., M.I.Mech.E.

HON. ARCHITECT: Mr. E. Keynes Purchase, F.R.I.B.A., F.S.I.

HON. LIBRARIAN: Mr. Herbert S. Stoneham.

AUDITORS: Messrs. Andrew W. Barr and Co.

SECRETARY: Mr. J. W. Orde.

The Royal Automobile Club was founded in December, 1897, and for the first few years its home was in Whitehall Court, London, S.W. The rapid rise in membership necessitated a migration, and in December, 1902, 119, Piccadilly, was opened to members. Then 18, Down Street, had to be utilised, not only as a motor house, but as offices; also part of 16, Down Street; and 108, Piccadilly. In 1908 the Scheme of Association—instituted to throw more responsibility on the provincial clubs—made it necessary to take 112, Piccadilly, as the headquarters of the associates. To-day the Club is housed in the palatial building in Pall Mall, erected by the Club, and specially adapted to its needs.

The Pall Mall building contains complete accommodation for the members, namely, card, billiard, reading, dining, smoking, and committee rooms, an up-to-date restaurant, the "Great Gallery" for receptions and concerts, about one hundred bedrooms, library, fencing room, swimming bath, Turkish bath, squash racquet courts, rifle range, physical culture room, bowling alley, photographic studio, and so forth, thus catering for the tastes of all. The official garage of the Club is at "Niagara," York Street, Westminster, S.W. A Government post office has been instituted at the Club—the only one of its kind in the United Kingdom—solely for the convenience of members. Here all the usual business of a post office is undertaken with the exception of the issue of licenses. Another recent feature is the installation of a typewriting bureau for the use of members.

All the departments of the Club are now housed under one roof, namely, Engineers (whose services are at the disposal of members and associates), Legal (with a fully qualified solicitor in charge), Touring (the issue of triptyques, preparation of routes, transport of cars, and general touring information), Associates, Driving and Mechanical Proficiency Certificates, Agenda (which is also the Roads, Competitions—other than technical—and Press Department, Year Book Office, etc.), Technical (for certified trials and technical tests, etc.), Accountants, etc.; and offices have also been allocated to the Auto-Cycle Unio and the Commercial Motor Users' Association.

The Club has a membership of 7,187, and is the largest of all the automobile clubs in the world. There are also 25,650 associates, not including the membership of the large number of foreign and colonial clubs affiliated to the parent body. It has enclosures or other facilities at Sandown Park, Ascot, Hurst Park, Lingfield Park, Brooklands, Bleakdown Golf Course, Henley Regatta, Richmond Horse Show, Olympia Motor Show, and at other meetings. The R.A.C. Golfing Society was formed in the early part of 1910, and has proved a popular feature of the sporting side of the Club's life.

The Club is the property of the Automobile Proprietary, Ltd., which consists solely of the members themselves, who assume a liability limited to £1, which is covered by the first annual subscription. It is governed by a committee consisting of fifty members elected by the membership.

The Club is the representative of the United Kingdom on the International Association of Recognised Automobile Clubs.

Its objects are the encouragement and development of the automobile movement; the provision for its members of a social club, and a centre of information and advice on matters pertaining to automobilism; and the advantage of its support in the protection and defence of their rights. The leading characteristics and advantages of the Club are as follows:

(a) It is a members' club.

(b) It provides—

(1) A suitable Club-house in London, with the usual social and residential accommodation and sporting facilities.

Associations, Societies, and Clubs.

(2) A Club library, containing maps, handbooks, and other touring and technical information, and general literature.
(3) A motor house adjacent to the Club for the storage of members' motor vehicles.
(4) A Club engineer, to examine cars and give advice, and apparatus for testing purposes.
(5) A Club journal to all members and associates free of cost.
(6) An Automobile Year Book, free to members and associates.
(7) Instruction in driving cars, and the issue of international passes and driving certificates which will be accepted by the authorities abroad.
(8) A register of motor servants.
(9) Touring and customs facilities for members and associates desiring to travel abroad.
(10) Distinguishing badges for members and associates in order to facilitate their recognition.

(c) It affords members and associates information and advice connected with the automobile movement.

(d) It organises trials and competitions from time to time.

(e) It holds lectures and discussions.

(f) It cultivates reciprocal relations with kindred institutions at home and abroad.

(g) It generally protects and encourages automobilism.

The Club consists of *(a)* Founder Members, *(b)* Life Members, *(c)* Honorary and Temporary Honorary Members, *(d)* Town and Country Members, and *(e)* Supernumerary Members.

Applicants for membership must be proposed by two members of the Club and their names and addresses and description of profession or calling must be displayed on the Club premises for at least ten days prior to the day of election. There is also a Candidates' Book at the Club.

Entrance Fee: For both town and country members, 25 guineas.

Subscription: Town members, 10 guineas; country members, 5 guineas.

The committee may elect as Temporary Honorary Members persons generally resident abroad for a period not exceeding two months during their sojourn in this country. The committee may also elect Ambassadors, Ministers, or other representatives of foreign countries, the Colonies, and India, as Temporary Honorary Members, and may elect the Secretaries, Attachés, etc., to membership without entrance fee, during the period of their official residence in this country. The committee may also elect as Temporary Honorary Members for a period not exceeding twenty-eight days in any one year representatives of associated or affiliated clubs.

The Automobile Association and Motor Union.

Head Offices: Fanum House, Whitcomb Street, Coventry Street, London. *Telegrams:* Fanum, London. *Telephone:* Regent 300.

City Offices: Guildhall Annexe, Guildhall Yard, E.C. *Telegrams:* Guilfanum, London. *Telephone:* 5692, London Wall.

The A.A. and M.U. also has offices at Manchester, Liverpool, Leeds, Birmingham, Norwich, Exeter, Plymouth, Dublin, Belfast, Glasgow, Edinburgh, and Paris.

President: The Earl of Lonsdale.

Chairman: Mr. W. Joynson-Hicks, M.P.

Vice-Chairmen: Sir Archibald J. Macdonald, Bart., J.P., and Mr. C. H. Dodd.

Hon. Treasurers: Messrs. W. Ballin-Hinde and L. Schlentheim.

Solicitors: Messrs. Amery-Parkes and Co., 18, Fleet Street, E.C.

Auditors: Messrs. Newson-Smith, Lord, and Mundy, 37, Walbrook, E.C.

Bankers: Messrs. Barclay and Co., Ltd., 19, Fleet Street, E.C.

Committee: Messrs. D'Arcy Baker, S. F. Edge, Walter Gibbons, Alfred Harris, Rev. F. W. Hassard-Short, Charles Jarrott, J. Kennedy, Dr. J. L. Lock, Charles McWhirter, P. A. Sharman, and Charles Temperley.

Motor Cycle Sub-committee: Mr. Charles Jarrott, Rev. F. W. Hassard-Short, and Mr. Robert W. Head.

Secretary: Mr. Stenson Cooke.

The A.A. and M.U. is an organisation formed as the result of an amalgamation between two important bodies, namely, the Automobile Association and the Motor Union. Motor cyclists as well as motor car owners are eligible for membership.

At the beginning of 1913 the total membership was nearly 60,000.

Among the chief objects of the Association are the protection and extension of the rights and privileges of motorists, the creation of a better understanding between all users of the road, and the repression of improper and inconsiderate driving.

The patrol organisation is the chief feature of the Association's work. This organisation now extends over thousands of miles of main roads, and the full staff is now being kept on the roads right through the winter months. The cost of the patrol organisation in wages alone now amounts to over £30,000 per annum.

The duties of the patrols are to give members information of interest concerning the road, warn them of any dangers on the highway, and render them all possible assistance in case of need. The men are specially selected for their ability to undertake minor roadside repairs, and the committee feels that the extraordinary success of the Association is chiefly due to the popularity of this portion of its work. The patrols are also equipped with first-aid wallets, which are at the service of all users of the highways.

During 1912 a system of roadside telephones was established to enable members to ring up garages for assistance, supplies, etc., or to obtain hotel accommodation in advance of their arrival. These telephones are free to the use of members.

Every member is entitled to the advice of the A.A. and M.U. solicitors upon any question arising under the Motor Car Act, 1903, and to be defended by them or a duly appointed agent in any proceedings under the Act in any police court in the United Kingdom, in respect of offences alleged to have been committed by him or his driver during his period of membership.

The Free Legal Defence Scheme has now been in force for nearly four years, and the very high percentage of successes achieved shows conclusively that it fills a real need. Members are entitled at all times to the advice and assistance of the Legal Department on any question respecting motoring, or the use and ownership of motor vehicles.

The A.A. and M.U. hotel system extends throughout England, Wales, Scotland, and Ireland. The hotels are being very carefully selected, passed, and classified on a five star basis by a special Hotels Committee before appointment. A special feature of the hotel system is that each officially appointed hotel displays in the entrance hall, or in a prominent position, the Association's bulletin board, in the centre of which is a locked cabinet containing road information supplied by members, agents, hotel proprietors, patrols, and inspectors, to each of whom a key is supplied. The bulletin board is a practical means of communicating road information to members, by whom it may also be utilised for messages. Toilet boxes, containing towels, combs, and brushes are also being fixed in hotels specially for the use of members.

Agents and repairers are distributed throughout Great Britain in all the important cities and towns and in numerous hamlets at intervals of a few miles along every main road in the kingdom. The system is now spread over 20,000 miles of road, and all the agents are in direct touch with a central department. The agents report periodically to the head office concerning the condition of the roads in their districts, and other local information of interest, which is always at the disposal of members.

Members can obtain at all times reliable road information and detailed itineraries of routes throughout the United Kingdom from the Touring Department, where an expert staff is in constant communication with agents, hotels, and special touring representatives throughout the country.

The Continental Touring Department assists members touring abroad with their cars. They can deposit with the Association the duty payable, and obtain triptyques or entry permits for their cars, which are recognised by the foreign customs authorities at each frontier. The whole of the duty is refunded on the return of the triptyque duly discharged to the Association. Arrangements have been made for shipment of members' cars on every steamship route to the Continent, and agents have been appointed at all the foreign ports, who meet members on arrival and render assistance in getting the car through the customs.

International passes can be issued to any motorist whose driver and car have been certified by the Association's examiners. These passes obviate the necessity of taking out driving licences or of registering cars in nearly all the countries on the Continent.

A.A. and M.U. agents and hotels have been appointed in all the principal towns in France, Germany, Italy, and Switzerland, Belgium, and Holland, where members will receive special attention. This system is being rapidly extended all over the Continent.

A great leal of valuable and practical work has been done by the Association in erecting village signs, direction signs, school signs, and other road warnings, and where, at night time, motorists might run into danger, illuminated signs are being put up.

Members requiring competent drivers and mechanics can obtain assistance from the Drivers' Department of the Association, which is working in conjunction with the Society of Automobile Mechanic Drivers, through which body suitable men are obtained for members.

The work of the Association also includes: Opposing applications for unnecesary speed limits. Watching over the interests of motorists in Parliament. Protecting motorists from the imposition of illegal or excessive bridge, ferry, and road tolls, and other dues and imposts. Discouraging and preventing inconsiderate and dangerous driving, both of motor cars and other vehicles. Agitating for better regulations for the lighting of all vehicles on public roads. Agitating for the proper limitation and apportionment of the taxation on motor cars and other vehicles, and generally of undertaking such work on behalf of motorists as can only be discharged by a strong and united body representative of all classes of motorists in the United Kingdom. Also securing just and impartial administration and enforcement of the laws affecting all users of the highway.

Annual subscription: Car owners, £2 2s.; Irish, colonial, and foreign members, £1 1s.; motor cyclist members, 10s. 6d.

The Institution of Automobile Engineers.

13, Queen Anne's Gate, Westminster, London, S.W.

President: Mr. T. B. Browne (London).

Vice-presidents: Messrs. J. S. Critchley (London), Max Lawrence (Manchester), and Mervyn O'Gorman (London).

Secretary: Mr. Basil H. Joy, 13, Queen Anne's Gate, Westminster, London, S.W.

The principal objects for which the Institution was established are:

To promote the science and practice of engineering as applied to the construction of automobiles, all forms of self-propelled and mechanically-propelled vehicles, motors, and to every kind of mechanical locomotion on land, on, or in, water, or in air; and to initiate and carry through any scheme or to organise any movement likely to be useful to the members of the Institution and to the community at large in relation thereto.

To hold meetings of the Institution for reading and discussing communications bearing upon engineering as applied to the matters enumerated above, or the applications thereof, or upon subjects relating thereto.

To enable engineers to correspond, and to facilitate the interchange of ideas respecting improvements in the various branches of the practice of engineering as applied to mechanical locomotion, and the publication and communication of information on such subjects to the members.

To establish scholarships, organise lectures, hold examinations, to grant premiums and prizes for papers and essays, and by any other similar means to enlarge the knowledge and improve the practice of engineering as applied to mechanical locomotion.

The Institution consists of Ordinary Members, Associate Members, Graduates, and Associates.

Candidates for admission as Ordinary Members must be persons not under twenty-five years of age, who, having occupied during a sufficient period a responsible position in connection with the practice of engineering as applied to mechanical locomotion, or otherwise proved their thorough knowledge of the theory and practice of automobile engineering, may be considered by the Council qualified for election.

Candidates for admission as Associate Members must have persons not under twenty-three years of age, who shall have been trained as engineers, and who shall be able to satisfy the Council that they have subsequently been employed in the practice and science of engineering as applied to mechanical locomotion for at least two years, and shall be actually engaged in the work of such engineering at the time of their application for election, and are considered by the Council to be qualified for election. They may be transferred at the discretion of the Council to the class of Members.

Graduates must be persons of any age who, at the time of election, are being trained as pupils to an automobile engineer, or are studying engineering as applied to mechanical locomotion, or who otherwise satisfy the Council that there are special circumstances which, in the opinion of the Council, entitle them to admission.

Candidates for admission as Associates must be persons not under twenty-five years of age, who, by reason of their scientific attainments or their position in the engineering industry as applied to mechanical locomotion, may be considered eligible by the Council, or persons not under the said age and not in the industry, who, for the interest they take in mechanical locomotion, may be considered eligible by the Council.

The Council have the power to elect as Honorary Members persons who, by reason of their past services to automobile engineering, or by other eminent qualification, are, in their opinion, eligible for that position.

Subscriptions: Ordinary Members, 3 guineas a year; Associate Members, 2 guineas a year; Associates, 2 guineas a year; Graduates, half-a-guinea a year; Life Composition Fee, £35.

Brooklands Automobile Racing Club.

Offices: Carlton House, Regent Street, London, S.W.

Motor Course and Flying Ground: Weybridge.

President: The Earl of Lonsdale.

Vice-president: Lord Montagu of Beaulieu.

Clerk of the Course: Major F. Lindsay Lloyd.

Secretary: Mr. Kenneth L. Skinner.

This Club was established in 1907 for the purpose of promoting races between mechanically-propelled contrivances of all descriptions.

Race meetings are regularly held throughout the summer months, the programmes including races for motor cars, motor cycles, and, latterly, aeroplanes.

The subscription to the Club is four guineas, with a reduction of one guinea in the case of members of the Royal Automobile Club, the Royal Aero Club, the Automobile Association and Motor Union, and the Motor Club. There is also an entrance fee of two guineas.

Members have the privilege of using the track at any time, and of visiting the flying ground. They also have admission for themselves and their cars to all race meetings held at the course under the auspices of the Club. Each member secures also the same privileges for two ladies.

The races at the various meetings are, generally speaking, open to all comers, but in order to differentiate between competitors interested in the motor industry, who have at their disposal the resources of factories and numerous workers, and the private individual who has no such resources, the committee of the B.A.R.C.. has established a body called "Private Competitors," on the general lines of "Gentlemen Riders of the Turf.". A Private Competitor requires re-election annually, and he need not be a member of the Brooklands Automobile Racing Club.

The track itself is about two and threequarter miles long and 100 feet wide, the surface being composed of cement. It is of an irregular oval shape, one curve being of a much greater radius than the other. Crossing the oval near the smaller curve is a straight portion, known as the finishing straight, upon each side of which the spectators assemble to witness the motor races.

The track is scientifically banked at the curves, so that the greatest speeds can be attained upon it in safety, and it may be remarked here that a Benz car in November, 1909, accomplished half a mile at a speed of 127.877 miles an hour.

The track has been furnished with a complete equipment of Col. Holden's electrical timing apparatus for the accurate timing of cars while travelling at speed. So sensitive is the mechanism that the results can be accurately certified to within a 1,000th of a second.

The Brooklands motor course has become the recognised venue for tests and trials of cars, and has proved itself of inestimable value in the promotion of the development of the British motor industry.

The ground surrounded by the motor course has been levelled, and is the most important aviation ground in this country. The forty aeroplane sheds are generally occupied, and most of the leading makes of aeroplanes are to be seen in flight when the weather and other conditions are favourable.

The charges for admission to non-members are: On race days, 2s. 6d. and 10s.; cars are admitted alongside the course at a charge of 10s., or may be left in the garage at a charge of 2s. 6d. On non-race days, the charge for admission is 1s., and a further charge of 2s. 6d. is made for cars proceeding to the flying ground.

The charge for the use of the motor course is £1 a day, and books of twelve tickets can be obtained for £4 10s. on application to the London office.

In addition to the race meetings held by the Brooklands Club, the British Motor Cycle Racing Club holds monthly motor cycle race meeting during the summer months, and other race meetings are occasionally held at Brooklands by the Royal Automobile Club, the Motor Cycling Club, and other important motoring bodies.

The Roads Improvement Association (Incorporated)

15, Dartmouth Street, Westminster, London, S.W.

The Roads Improvement Association (Incorporated) was established in 1886, and exists to obtain for the public better, wider, dustless, and more conveniently planned roads and footways.

In prosecution of this object, it has, *inter alia*, with exceptional success, promoted the movement for the reform of the system of highway administration, initiated and fostered efforts to deal with the dust nuisance, and utilised every opportunity of increasing the knowledge available upon all road matters.

The Association is the recognised and only national organisation in Great Britain representing all classes of road users, viz., automobilists, cyclists, pedestrians, and users of horse-drawn vehicles, commercial motor vehicles, motor cabs, traction engines, and public service vehicles, in road matters. With its constituent bodies, the Association represents upwards of 180,000 road users.

Exceptional success has attended the Association's past twenty-five years' work, and it has in the last two years greatly extended its activities. Provincial branches have been established and are being maintained as follows:

Bristol Centre (embracing Gloucestershire, Somersetshire, and Wiltshire).—Headquarters: Bristol.

Derbyshire Centre.—Headquarters: Derby.

East Surrey Centre.—Headquarters: Croydon.

Lancashire and Cheshire Centre.—Headquarters: Manchester.

Leicestershire and Rutland Centre.—Headquarters: Leicester.

Midland Centre (embracing Staffordshire, Warwickshire, and Worcestershire).—Headquarters: Birmingham.

Middlesex Centre.—Headquarters: London, S.W.

Sussex Centre.—Headquarters: Lewes.

South Wales Centre (embracing Breconshire, Cardiganshire, Carmarthenshire, Glamorganshire, Monmouthshire, Pembrokeshire, and Radnorshire).—Headquarters: Cardiff.

Yorkshire (West Riding) Centre.—Headquarters: Leeds.

Centres in other parts of the country are now in process of formation.

H.R.H. Prince Arthur of Connaught, K.G., G.C.V.O., is the president of the Association, and its vice-presidents are the Hon. Arthur Stanley, M.P., W. Joynson-Hicks, M.P., and Ed. Manville, M.I.E.E. For its chairman it has Mr. Robert Todd, who for years has been known as an enthusiast in road matters; its vice-chairmen comprise Colonel R. E. Crompton, C.B., M.Inst.C.E., well known as the consulting engineer of the Road Board, and Mr. H. Percy Boulnois, M.Inst.C.E., late chief engineering inspector at the Local Government Board and a member of the Road Board's Advisory Committee of Engineers. Mr. E. S. Shrapnell-Smith, as honorary treasurer, represents the claims of the commercial motor vehicle, and Mr. Wallace E. Riche acts as secretary. The Council, a comparatively large one, consists of representatives of the Royal Automobile Club, the Automobile Association and Motor Union, the Cyclists' Touring Club, the National Cyclists' Union, the Commercial Motor Users' Association, the National Traction Engine Owners, the London Motor Cab Proprietors' Association, and three others representing individual members.

The need for reform in the system of highway administration has been so successfully urged by the Association upon the Government, the House of Commons, and the State Departments concerned, that a Departmental Committee was appointed by the President of the Local Government Board in 1903 to enquire into the administration of the highways in England and Wales, and also whether any change in the authorities who control the roads was required. In the report of the Committee a number of the Association's suggestions were adopted. The Roads Improvement Association's proposals were also placed before the Royal Commissions on London Traffic and on Motor Cars, both of whom made recommendations in accordance with the Association's representations.

The passing of the Development and Road Improvement Funds Act, 1909, marks the success of the Association's advocacy for an Imperial Grant-in-aid for the improvement of our highways, also for the establishment of a Central Highway Authority to administer such a grant and to assist the local authorities to improve their roads. Included in the new duties that devolve upon the Association by the establishment of the Road Board are (1) the initiation and development of schemes for the improvement of arterial roads, extending through the areas of several highway authorities that will mainly benefit "through traffic," and (2) the organisation and maintenance of efficient machinery to ensure that the views and requirements of road users are properly placed before the Road Board and the highway authorities for consideration in connection with the administration of the Imperial Road Improvement Fund Grant.

The Roads Improvement Association was the first body in Great Britain to conduct experiments to mitigate the dust nuisance. In 1902 experiments with petroleum for fixing the surface dust were arranged. With a view to popularising and thoroughly testing the use of tar as a dust preventive and also reducing the cost of the application of the material to the road, the Roads Improvement Association organised in 1907 two competitions to determine (1) the best tar-spreading machine and (2) the most suitable preparation of tar for road purposes. Considerable interest was aroused by these competitions, and a great impetus given to the use of tar for road purposes. An official test has also been conducted of calcium chloride as a dust-laying material.

Information and advice upon the mitigation of the dust nuisance or upon any matter connected with the improvement of the roads is gladly supplied by the Association. No pains are spared by the Council to obtain information or to assist its members and enquirers. The Association has always acted, to the fullest extent of its limited resources, as a Central Intelligence Department for all matters appertaining to roads. From time to time the Association has compiled and published pamphlets dealing with highway administration, dustless road construction, the use of dust-laying materials, and various other aspects of the road question.

The Association is dependent entirely upon voluntary subscriptions for its support, and is in need of additional financial aid to enable it to develop its various proposals.

Road users are strongly urged to write to the secretary to the Association for a copy of its last Annual Report and details of its various road improvement schemes and proposals.

Membership subscription has been fixed at 5s. per annum to enable all classes of road users to lend their support. Users of commercial and pleasure motor vehicles are asked, however, to subscribe £1 1s. annually.

The Society of Motor Manufacturers and Traders, Ltd.

This Society for the protection, encouragement, and development of the automobile industry was formed in July, 1902.

The membership rapidly included the leading manufacturers and concessionnaires, not only of pleasure cars, but also of commercial vehicles, tyres, and accessories of every kind; also motor boat constructors, and those carriage builders who had commenced to cater for the motor industry. Consequently, it has been able from an early date to represent all branches of the industry in connection with legislation, Local Government Board, or Board of Trade regulations, etc.

In order to deal with these varying interests trade sections were formed, each having its own committee. At the present time there are nine such committees, namely, Accessories and Components, Aero, Agents, British Manufacturers, Carriage Builders, Commercial Vehicles, Foreign Manufacturers, Marine, and Tyres.

The question of standardisation of automobile parts has received considerable attention by the Society, working in conjunction with the Engineering Standards Committee. For example, the Accessories Committee recommended standards for sparking plug threads and lamp brackets, whilst the Marine Committee dealt with keys and keyways, and the Tyre Committee with rim standardisation. A special committee of technical representatives was formed in 1912, known as the Standardisation Committee.

There are eighteen local sections of the Society, covering England, Wales, and Ireland, each section having its own committee. All these sections are represented on the committee of the Agents' Section of the Society, which meets at Maxwell House, and thereby links up the work throughout the country.

The Society is governed by a Council and a Committee of Management. The president of the Society, who is also president of the Council, is Mr. E. Manville, who was elected to that office in 1907, and who has now been five times re-elected. The first president of the Society was Mr. Frederick R. Simms, who was succeeded by Mr. Sidney Straker.

The Society is affiliated to the London Chamber of Commerce, and by means of Joint Committees, or otherwise, works in connection with a very large number of associations and societies. There is a Standing Joint Committee with the Royal Automobile Club for the purpose of discussing matters, such as trials, competitions, etc., affecting the industry.

In January, 1912, the Society took part at a meeting in Brussels, when it was decided to form an International

Union of representative motor trade associations. At this meeting, Belgium, France, Germany, and Great Britain were represented, and it was decided to form a committee of the Union, the meetings of which should be held in the various countries in turn. The first meeting of this committee was held at Maxwell House in June, 1912, when Austria joined the Union.

The motor exhibitions of the Society have, since 1904, been held at Olympia, and are well known to, and largely patronised by, the public. In addition to motor car exhibitions, the Society has held exhibitions of commercial vehicles, motor boats, and aeroplanes and airships.

The Society has also taken part in two foreign exhibitions, namely, the Brussels International Exhibition, 1910, and the Turin International Exhibition, 1911. The collective exhibits organised by the Society at these exhibitions were in charge of Mr. W. George Williams, and it is probable that the Society will in future be similarly represented not only at international universal exhibitions, but also at foreign motor exhibitions.

In 1910, the Society bought the shares of the Manchester and District Motor Trades' Association (which controlled the Manchester motor shows), and undertook to hold during four years a motor exhibition in Manchester, which has become known as the North of England Motor Show.

The Trade Information Department compiles and issues to members statistics of motor imports and exports, and keeps members informed with regard to changes of colonial and foreign tariffs affecting motor goods. In addition, this department has compiled a unique register of information which is not generally available, and by this means is able to answer enquiries on the most diverse subjects in any way bearing on the motor trade. Also the department compiles such lists as are obtainable of motor traders in the colonies and abroad.

The Enquiry Department collects information as to the nature of the business carried on by all parties in this country known to be in the motor trade, and compiles a classified register giving this information to members.

The funds of the Society have been used to test numerous legal points of general interest to the trade, and in support of events calculated to advance the industry generally. Instead of forming a separate fund, the Society contributed to the Cycle Trade Benevolent Fund, which then became the Cycle and Motor Trades' Benevolent Fund.

The International Association of Recognised Automobile Clubs.

The above body was formed in order to secure united action throughout the various countries in respect of those matters of policy or practical work that are common to all motor car users. The principal motor organisation in each country was invited to join, each organisation being entitled to send delegates up to five in number to form the committee. The following is a list of the recognised clubs forming the Association :

- Royal A.C. of England
- A.C. of America
- Imperial Royal A.C. of Austria
- Royal A.C. of Belgium
- A.C. of Denmark
- A.C. of Egypt
- A.C. of France
- Imperial A.C. of Germany
- A.C. of Holland
- Royal A.C. of Hungary
- A.C. of Italy
- A.C. of Norway
- A.C. of Portugal
- A.C. of Roumania
- Imperial A.C. of Russia
- Royal A.C. of Spain
- Royal A.C. of Sweden
- A.C. of Switzerland

Generally speaking, the clubs in the Association control automobilism from an international point of view on lines similar to those adopted by the jockey clubs for the international control of horse racing. For instance, when new records are created or existing records lowered the new times or distances cannot be classed as "world's records" until they are passed by the International Association of Recognised Automobile Clubs. An official list of "world's records" confirmed by the Association at its last meeting (December, 1912) will be found on page 46.

The Association holds periodical meetings in Paris. Secretary : M. Voltaire Clovis, 8, Place de la Concorde, Paris.

The Attractiveness of a Hill-climbing Competition.

The majority of the spectators always gather at the bends, that is if there are any on the course, and there generally are. This picture, taken at Shelsley Walsh last year, illustrates the great interest motorists take in this and similar events.

Colonial and Foreign Clubs.

Section II.—Colonial Clubs.

[Section I. contains *résumés* of the principal home clubs and governing bodies. It will be found on page 105.

R.A.C. of South Africa—
Headquarters: Markham's Buildings, Cape Town.
Hon. Secretary: Mr. J. M. P. Muirhead, J.P., P.O. Box No. 1,161, Cape Town.

Natal A.C.—
Headquarters: 49, Tenth Avenue, Durban.
Hon. Secretary: Mr. G. E. Watts.

A.C. of Rhodesia—
Headquarters: Bulawayo.
Hon. Secretary: Mr. A. E. Knowles.

Transvaal A.C.—
Headquarters: Grand National Hotel, Johannesburg.
Secretaries: Mr. T. Greig and Mr. P. Wilkinson, P.O. Box No. 2,154, Johannesburg.

A.C. of Australia—
Headquarters: Challis House, Martin Place, Sydney, N.S.W.
Secretary: Mr. H. C. Morgan.

A.C. of Victoria—
Headquarters: 91, Elizabeth Street, Melbourne, Victoria.
Secretary: Mr. H. W. Chenoweth.

A.C. of Queensland—
Headquarters: Eagle Chambers, Brisbane, Queensland.
Secretary: Mr. David Service.

A.A. of South Australia—
Headquarters: Steamship Buildings, Currie Street, Adelaide.
Secretary: Mr. A. Laughton.

A.C. of Western Australia—
Headquarters: St. George's Terrace, Perth.
Hon. Secretary: Mr. S. D. Eden.

A.C. of Tasmania—
Headquarters: Hobart.

A.C. of Canada—
Headquarters: Montreal.
Secretary: Mr. G. A. McNamee.

Ontario Motor League—
Headquarters: Toronto.
Secretary: Mr. E. M. Wilcox, 118, Stair Buildings, 123, Bay Street, Toronto.

Vancouver M.C.—
Headquarters: Vancouver, B.C.
Secretary: Mr. C. W. Draper, 2, Imperial Block, Pender and Seymour Streets, Vancouver.

A.C. d'Egypte—
Headquarters: 27, Chareh-el-Madabegh, Cairo.
Secretary: M. le Baron E. G. Rey.

A.C. of Ceylon—
Headquarters: Queen's Hotel, Kandy.
Secretary: Mr. Harold North, Queen's Hotel, Kandy.

A.A. of Bengal—
Headquarters: 1, Park Street, Calcutta.
Hon. Secretary: Mr. E. J. Oakley.

South Indian M.U.—
Hon. Secretaries: Mr. H. B. Pierce, Mount Road, Madras; Mr. G. V. Scovell, Bangalore; and Capt. Sturrock, R.A., Nilgiris.

M.U. of Western India—
Headquarters: 1, Esplanade Road, Fort, Bombay.
Hon. Secretary: Mr. N. M. Marshall.

Jamaica M.C.—
Hon. Secretary: Mr. H. H. Dunn, 31, Duke Street, Kingston.

Malta A.C.
Hon. Secretary: Lieut. G. M. Morrell, R.E.

Auckland A.A.—
Headquarters: Vulcan Lane, Auckland, N.Z.
Hon. Secretary: Mr. A. Cleave, Vulcan Lane, Auckland.

Canterbury A.A.—
Headquarters: Gloucester Street, Christchurch, N.Z.
Secretary: Mr. E. Nordon.

Nelson A.A.
Hon. Secretary: Mr. M. A. Jenny, Nelson, N.Z.

Selangor M.U.—
Headquarters: Kuala Lumpur, F.M.S.
Hon. Secretary: Mr. D. A. Christie.

Perak M.U.—
Headquarters: Ipoh, Perak, F.M.S.
Hon. Secretary: Mr. F. A. Harrison.

Singapore A.C.—
Hon. Secretary: The Hon. Evelyn C. Ellis, 10, Collyer Quay, Singapore, S.S.

Section III.—Foreign Clubs.

A.C. of Algeria—
Headquarters: 23, Boulevard Carnot, Algiers.
Secretary: Baron de Viviers.

A.C. of Argentina—
Headquarters: Calli Maipu 1,241, Buenos Ayres.
Secretary: Senor J. Pacheco y Anchorena.

A.C. of Brazil—
Secretary: Senor Raul de Freitas Cressiuma, Praia de Botafogo 308, Rio de Janeiro.

A.C. of America—
Headquarters: 54th and 55th Streets, West of Broadway, New York City.
Secretary: Mr. Charles E. Forsdick.

American Motor League—
Headquarters: Vanderbilt Building, New York City.
Secretary: Mr. Robert O. Brockway.

Royal A.C. of Belgium—
Headquarters: 17a, Avenue de la Toison d'Or, Brussels.
Secretaries: MM. P. d'Aoust and A. Michaut.

Antwerp A.C.—
Headquarters: 40-42, Grand Place, Antwerp.
Secretary: M. Th. Ratinckx.

A.C. of China—
Headquarters: Shanghai.
Hon. Secretary: Mr. E. Byrne, c/o Shanghai Waterworks Co., Ltd., Shanghai (*viâ* Siberia).

A.C. of Denmark—
Headquarters: Oestergade 26 (111), Copenhagen K.

A.C. of France—
Headquarters: 6, Place de la Concorde, Paris.
Secretary: M. Ch. Ward.

Imperial A.C. of Germany—
Headquarters: 9, Leipzigerplatz 16, Berlin W.
Secretary: Konter-Admiral a. D. Rampold.

Royal A.C. of Bavaria—
Headquarters: 5, Briennerstrasse, Munich.
Secretary: Fürst Oscar von Wrede.

A.C. of Holland—
Headquarters: Buitenhofs 5, The Hague.
Secretary: B. W. van Welderen Baron Rengers.

A.C. of Italy—
Headquarters: 13, Via Bogino, Turin.
Secretary: Count Gastone di Merafiore.

Touring Club of Italy—
Headquarters: Via Monte Napoleone 14, Milan.
Secretary: Cav. Innocenzo, Vigliardi, Paravia.

A.C. of Norway—
Headquarters: Tordenskjoldsgate 6b, Christiana.
Secretary: Sigurd Hiorth.

A.C. of Portugal—
Headquarters: Rua Henriques Nogueira, Lisbon.
Secretary: Senhor Rodrigo Peixoto.

A.C. of Roumania—
Headquarters: Rue C. A. Rosetti 7, Bucharest.
Secretary: Jean T. Ghica.

Imperial A.C. of Russia—
Headquarters: Quai de la Cour 10, St. Petersburg
Secretary: B. Postnikoff.

A.C. of Poland—
Headquarters: Hotel Bristol, Warsaw.

Royal A.C. of Spain—
Headquarters: 48, Alcala, Madrid.
Secretary: Senhor D. Carlos Resines.

Royal A.C. of Sweden—
Headquarters: Fenix-Palatset, Adolf Fredrike Kyrkogata 10, Stockholm.
Secretary: Erland Bratt.

English-French Dictionary.

The Principal Motor Terms in Constant Use.

English.	French.
Accelerator	Accélérateur.
Accumulator	Accumulateur.
Adjusting screw	Vis de réglage.
Air pump	Pompe à air.
Air tube	Chambre à air.
Air valve	Soupape à air.
Alcohol	Alcool.
Ammeter	Ampèremètre.
Apron	Tablier.
Armature	Induit.
Axle	Essieu.
Backfire	Explosion prématuré.
Back wheel	Roue d'arrière.
Ball bearings	Coussinets à billes.
Band brake	Frein à tambour.
Battery	Batterie, pile.
Bearing	Coussinet, palier.
Bevel wheel	Roue conique.
Blacksmith	Forgeron.
Bolt	Boulon.
Bonnet	Capôt.
Box spanner	Clef à douille.
Brake	Frein.
Brake drum	Frein à tambour.
Brake lever	Levier du frein.
Brake rod	Tige de frein.
Breakdown	Panne.
Bridge	Pont.
Burner	Bruleur.
Canopy	Dais.
Cap	Couvercle.
Carburetter	Carburateur.
Chain	Chaîne.
Chain wheel	Roue de chaîne.
Change speed lever	Levier de changement de vitesse.
Clutch	Embrayage.
Clutch pedal	Pédale de débrayage.
Clutch spring	Ressort d'embrayage.
Coil	Bobine.
Combustion chamber	Chambre d'explosion.
Compression tap	Robinet de compression.
Contact breaker	Interrupteur.
Copper wire	Fil de cuivre.
Counter-shaft	Contre-arbre.
Crank chamber	Carter.
Crankshaft	Arbre à manivelle.
Cylinder	Cylindre.
Cylinder head.	Culass
Dangerous hill	Descente dangereuse.
Differential	Différentiel.
Drain cock	Robinet de purge.
Driving axle	Essieu moteur.
Driving chain	Chaine de transmission.
Dust	Poussière.
Emery	Emeri.
Enamel	Email.
Engine	Engin.
Exhaust	Echappement.
Exhaust valve	Soupape d'échappement.
Exhaust valve spring	Ressort de soupape d'échappement.
Explosion	Explosion.
Fan	Ventilateur.
Felt	Feutre.
File	Lime.
Float	Flotteur.
Flywheel	Volant.
Foot brake	Frein à pédale.
Frame	Chassis.
French chalk	Talc.
Friction	Frottement.
Front axle	Essieu d'avant.
Front wheel	Roue d'avant.
Funnel	Entonnoir.
Gas	Gaz.
Gauge	Jauge, manometre.
Gear	Engrenage.
Gear box	Boite de vitesses.
Gloves	Gants.
Goggles	Lunettes.
Gradient	Pente.
Grease	Graisse.
Hammer	Marteau.
Handle	Manette.
Headlight	Phare.
Hood	Capote.
Horn	Corte.
Horn bulb	Poire.
Horn reed	Auche.
Horse-power	Cheval-vapeur.
Hot	Chaude.
Ignition lever	Manette d'allumage.
Inlet valve	Soupape d'admission.
Inner tube	Chambre à air.
Insulation	Isolation.
Jack	Cric.
Jet (carburetter)	Gicleur.
Key	Clef, Calle.
Lamp	Lampe.
Lamp bracket	Porte-lanterne.
Lamp oil	Huile à brûler.
Lamp wick	Mèche.
Lever	Levier.
Licence	Permit.
Link (chain)	Maillon.
Locknut	Contre écrou.
Lubricator	Graisseur.
Luggage carrier	Porte-bagage.
Magneto ignition	Allumage par magnéto.
Map	Carte.
Misfire	Raté.
Mudguard	Garde-boue.
Nail	Clou.
Non-skid	Anti-derapant.
Nut	Ecrou.
Oil	Huile.
Oilcan	Burette.
Outer cover	Enveloppe.
Overheating	Surchauffage.
Paraffin	Huile de petrole.
Petrol	Essence.
Petrol tank	Réservoir à l'essence.
Pin (split)	Goupille fendue.
Piston	Piston.
Piston ring	Segment du piston.
Piston rod	Tige du piston
Pliers	Pince.
Plug (sparking)	Bougie.
Pump	Pompe.
Puncture	Crevaison de pneumatique.
Radiator	Radiateur.
Reversing gear	Changement de marche.
Revolution	Tour.
Rim	Jante.
Rivet	Rivet

English.	French.
Rope	Corde.
Rug	Couverture.
Screw	Vis.
Screwdriver	Tournevis.
Shaft	Arbre.
Sideslip	Dérapage.
Silencer	Silencieux.
Soap	Savon.
Spanner	Clef.
Spindle	Fuseau.
Spoke	Rayon.
Sprag	Béquille.
Spring	Ressort, Roue à.
Sprocket wheel	Chaîne., Pignon
Starting handle	Manivelle de marche.
Steering wheel	Roue directrice.
Switch	Interrupteur.
Tank	Réservoir.
Tap	Robinet.
Terminal	Borne.

English.	French.
Throttle	Réglage à main.
Toolbox	Boite à outils.
Tools	Outils.
Tyre	Pneumatique.
Tyre lever	Demont pneu.
Universal joint	Cardan.
Valve	Soupape.
Valve seat	Siège de soupape.
Vice	Etau.
Voltmeter	Voltmètre.
Vulcanised	Vulcanisé.
Washer	Rondelle.
Water	Eau.
Weight	Poids.
Wheel	Roue.
Wick	Mèche.
Wire	Fil.
Workshop	Atelier.
Wood	Bois.

Speed per Hour.

The following Table shows the Speed per Hour in Miles and Kilometres when the Time for ⅛, ¼, ½, or 1 Mile is known.

Time for ⅛ mile.	Time for ¼ mile.	Time for ½ mile.	Time for 1 mile.	Miles per hour.	Kilos. per hour.
sec.	m. s.	m. s.	m. s.		
45.00	1 30	3 0	6 0	10.00	16.09
40.50	1 21	2 42	5 24	11.11	17.83
37.50	1 15	2 30	5 0	12.00	19.31
36.00	1 12	2 24	4 48	12.50	20.11
33.75	1 7.5	2 15	4 30	13.33	21.45
31.50	1 3	2 6	4 12	14.28	22.98
30.00	1 0	2 0	4 0	15.00	24.14
28.50	57	1 54	3 48	15.79	25.41
26.25	52.5	1 45	3 30	17.14	27.58
24.75	49.5	1 39	3 18	18.18	29.25
22.50	45	1 30	3 0	20.00	32.18
21.25	42.5	1 25	2 50	21.17	34.07
20.62	41.2	1 22	2 45	21.81	35.10
19.37	38.7	1 17	2 35	23.22	37 37
18.62	37.5	1 15	2 30	24.00	38.62
18.00	36	1 12	2 24	25.00	40.23
16.87	33.7	1 7	2 15	26.66	42.90
16.00	32	1 4	2 8	28.12	45.25
15.00	30	1 0	2 0	30.00	48.28
14.37	28.7	57	1 55	31.30	50.37
13.75	27.5	55	1 50	32.72	52.65
13.50	27	54	1 48	33.33	53.64
13.12	26.2	52	1 45	34.28	55.17

Time for ⅛ mile.	Time for ¼ mile.	Time for ½ mile.	Time for 1 mile.	Miles per hour.	Kilos. per hour.
sec.	sec.	sec.	m. s.		
12.75	25.5	51	1 42	35.29	56.79
12.50	25	50	1 40	36.00	57.93
12.25	24.5	49	1 38	36.73	59.11
11.87	23.7	47	1 35	37.89	60.98
11.62	23.2	46	1 33	38.71	62.29
11.25	22.5	45	1 30	40.00	64.37
10.87	21.7	43	1 27	41.38	66.59
10.62	21.2	42	1 25	42.35	68 15
10.25	20.5	41	1 22	43.90	70.65
10.00	20	40	1 20	45.00	72.42
9.75	19.5	39	1 18	46.15	74.27
9.37	18.7	37	1 15	48.00	77.25
9.00	18	36	1 12	50.00	80.46
8.75	17.5	35	1 10	51.43	82.77
8.12	16.2	32	1 5	55.38	89.12
7.50	15	30	1 0	60.00	96.56
6.87	13.7	27	55	65.45	105.33
6.25	12.5	25	50	72.00	115.87
5.62	11.2	22	45	80.00	128.74
5.00	10	20	40	90.00	144.84
4.37	8.7	17	35	102.85	165.52
3.75	7.5	15	30	120.00	193.12

Cylinder Bores and Strokes in Millimetres and Inches.

An Approximate Guide for Comparison.

Millimetres. Bore.	Stroke.	Inches. Bore.	Stroke.
70	× 130	= $2\frac{3}{4}$	× $5\frac{1}{8}$
75	× 120	= 3	× $4\frac{3}{4}$
75	× 130	= 3	× $5\frac{1}{8}$
83	× 86	= $3\frac{1}{4}$	× $3\frac{3}{8}$
84	× 90	= $3\frac{5}{16}$	× $3\frac{9}{16}$
80	× 120	= $3\frac{3}{16}$	× $4\frac{3}{4}$
80	× 130	= $3\frac{3}{16}$	× $5\frac{1}{8}$
80	× 135	= $3\frac{3}{16}$	× $5\frac{3}{8}$
80	× 140	= $3\frac{3}{16}$	× $5\frac{1}{2}$
80	× 150	= $3\frac{3}{16}$	× $5\frac{15}{16}$
85	× 135	= $3\frac{3}{8}$	× $5\frac{3}{8}$
85	× 120	= $3\frac{3}{8}$	× $4\frac{3}{4}$

Millimetres. Bore.	Stroke.	Inches. Bore.	Stroke.
90	× 90	= $3\frac{9}{16}$	× $3\frac{9}{16}$
89	× 127	= $3\frac{1}{2}$	× 5
90	× 120	= $3\frac{9}{16}$	× $4\frac{3}{4}$
90	× 130	= $3\frac{9}{16}$	× $5\frac{1}{8}$
100	× 115	= $3\frac{15}{16}$	× $4\frac{9}{16}$
100	× 130	= $3\frac{15}{16}$	× $5\frac{1}{8}$
100	× 140	= $3\frac{15}{16}$	× $5\frac{1}{2}$
110	× 125	= $4\frac{5}{16}$	× $4\frac{15}{16}$
120	× 140	= $4\frac{3}{4}$	× $5\frac{1}{2}$
124	× 146	= $4\frac{7}{8}$	× $5\frac{3}{4}$
128	× 150	= $5\frac{1}{16}$	× $5\frac{15}{16}$
130	× 140	= $5\frac{1}{8}$	× $5\frac{1}{2}$

English and Metric Weights and Measures.

1 kilogramme	=	2.2	lbs. approx.
1 lb.	=	453.6	grammes.
1 lb.	=	.4536	kilogramme.
1 cwt.	=	50.8	kilogrammes.
1 ton	=	1,016	kilogrammes.
1 litre	=	1.75	pint approx.
1 pint	=	.568	litre.
1 quart	=	1.135	litre.
1 gallon	=	4.543	litres.
1 cubic foot	=	28.3	litres.
1 cubic metre	=	35.3	cubic feet.

Measures of Length.

1 kilometre	=	.6214	mile, $\frac{5}{8}$ mile approx.
1 metre	=	39.3701	inch.
1 centimetre	=	.3937	inch.
1 millimetre	=	.0394	inch, $\frac{1}{25}$ inch approx.
1 inch	=	25.4	millimetres.
1 foot	=	30.48	centimetres.
1 mile	=	1,609.315	metres.

INDEX.

INDEX. *Continued.*

Classified Index to Advertisers.

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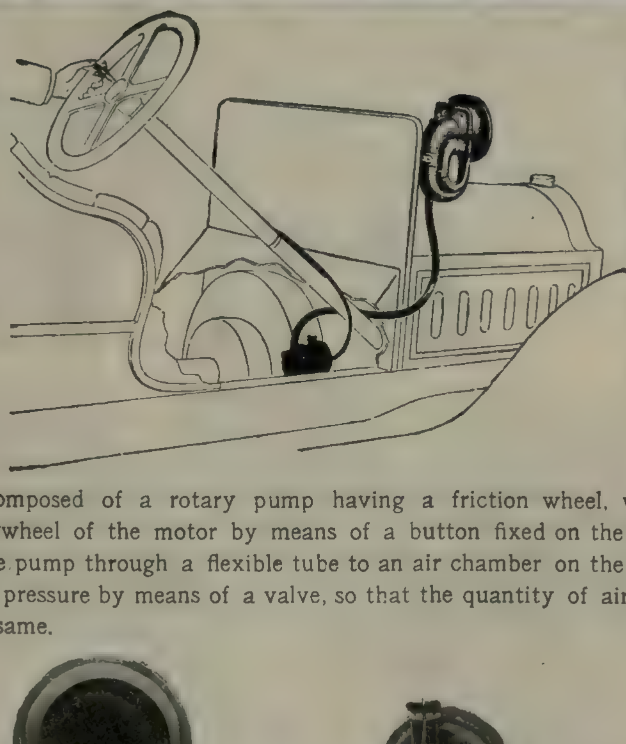
The Ideal Horn for Town or Country. A Short or Prolonged Note at will.



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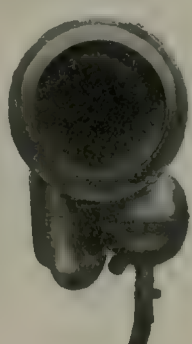

Fig. 1.

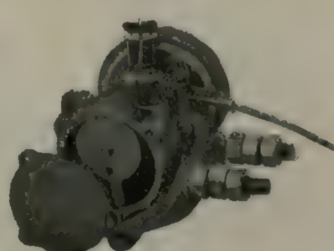

Fig. 2.

Nickel or Black £6 16 0.

Fig. 1. Trumpet, air Chamber and Valve.
Fig. 2. Pump with cover removed.

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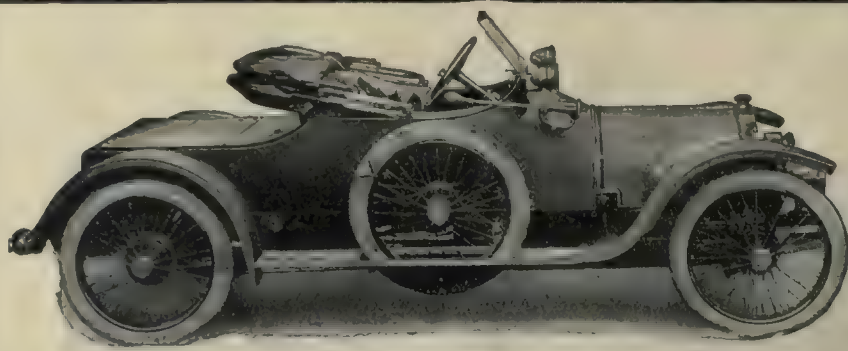

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A A	1¼″	85 mm.	£6 10 0
B B	1½″	100 mm.	£7 10 0
B X	1¾″	125 mm.	£8 10 0
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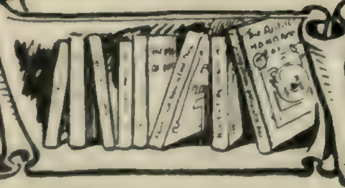

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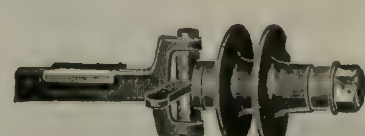

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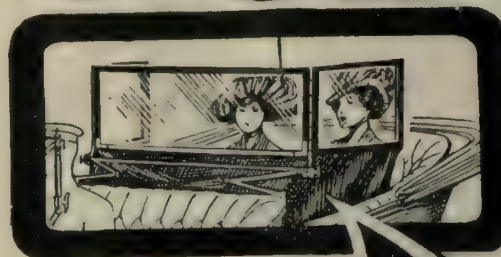

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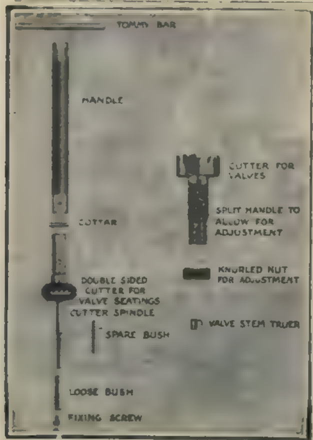

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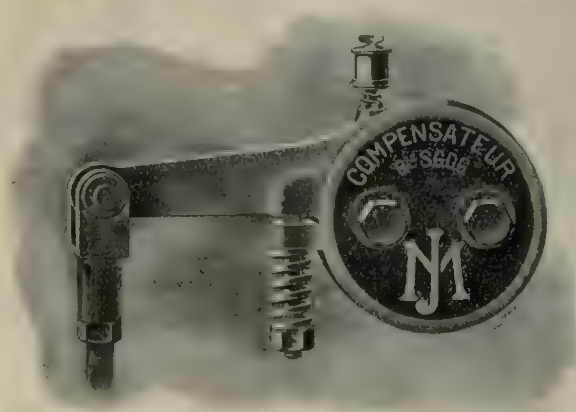

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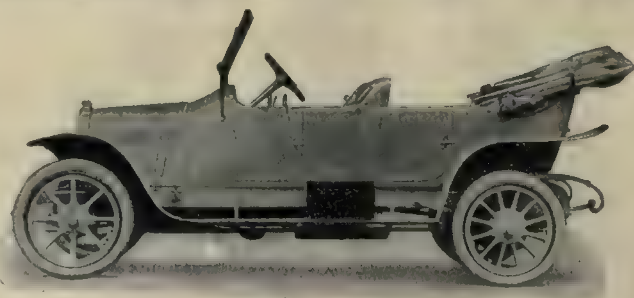

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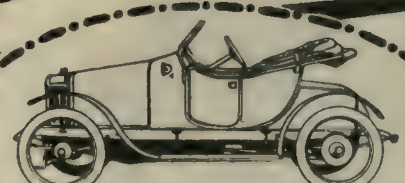

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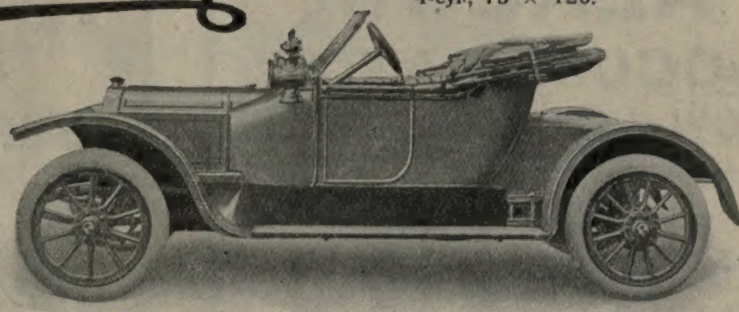

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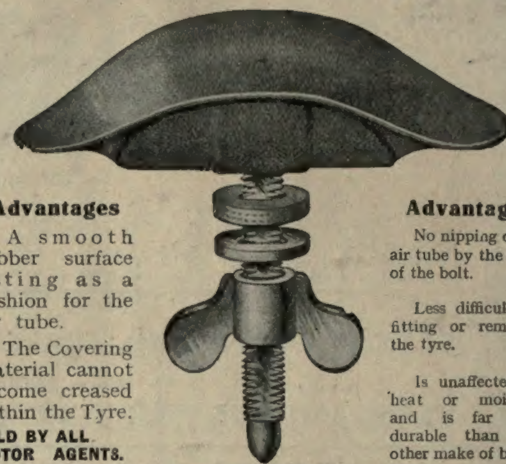

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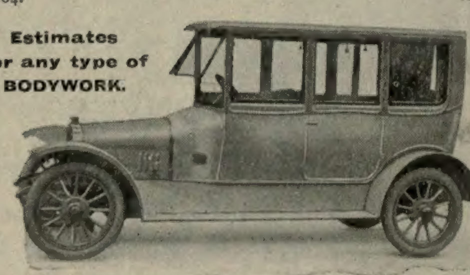

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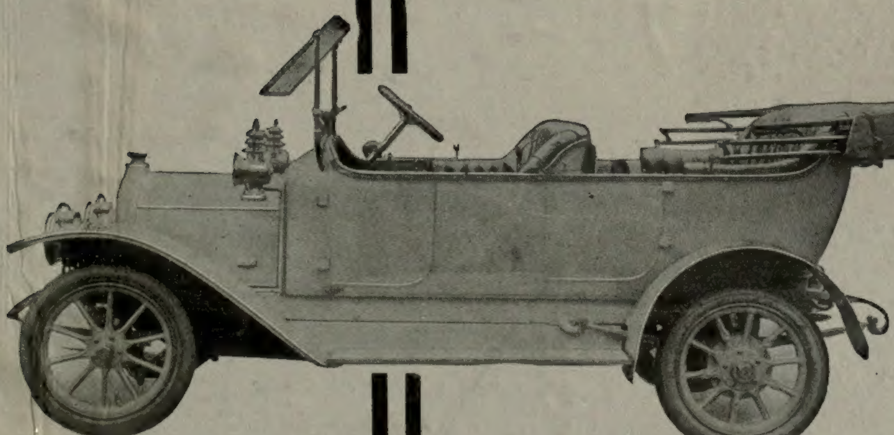

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